City Archives Building
Redevelopment
Winnipeg, MB
#788-2024B

CONSULTANTS

ARCHITECTS

MCM Architects Inc.
141 St. Anne's Road
Winnipeg, Manitoba R2M 2Z3
Email: Dan Long dlong@mcmarchitects.ca
info@mcmarchitects.ca

260-8th Street
Brandon, Manitoba R7A 3X3

B306 - 22 1st Avenue N
Martensville, Saskatchewan S0K 2T0

STRUCTURAL

Crosier Kilgour & Partners Ltd.
275 Carlton Street
Winnipeg, MB R3C 5R6
Tyler Smeall tyler.smeall@crosierkilgour.com

CIVIL

Neegan Burnside
307 Commerce Drive,
Winnipeg, Manitoba, R3P 1B3
Ruben Enns Ruben.Enns@neeganburnside.com

MECHANICAL

Alliance Engineering
1035 Logan Avenue
Winnipeg, Manitoba R3E 1P6
Ian Urqhaurt Ian@allianceengservices.com

ELECTRICAL

MCW Consultants
210-1821 Wellington Avenue
Winnipeg, Manitoba R3H 0G4
Matt Borody mborody@mcw.com

#2624

PROVINCE OF MANITOBA
MCM Architects Inc.
No. 025
APPROVED ARCHITECTURAL CORPORATION

PROVINCE OF MANITOBA
DAVID HOAG
2025-03-07
REGISTERED ARCHITECT

No. of Pages

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Part 1 GENERAL

1.1 SOILS INVESTIGATION

.1 Any information pertaining to soils and all borehole logs are furnished by the Contract Administrator as a matter of general information only and borehole descriptions or logs are not to be interpreted as descriptive of conditions at locations other than those described by the boreholes themselves.

.2 Included in Appendix A is a geotechnical investigation report titled "Geotechnical Report, City Archives Building Expansion Development, 380 William Street, Winnipeg, Manitoba", and prepared by WSP.

.3 The purpose of the report is to provide geotechnical information of the site and recommendations for the design of the permanent foundation engineering Work.

.4 The report may not reveal all conditions that exist or can occur on the site. The Contractor should conduct further investigation, as he deems necessary.

1.2 SITE SURVEY

.1 Survey plans of the site and its immediate surroundings have been prepared by a registered land surveyor and have been included with the Bid Documents for information.

1.3 HAZARDOUS BUILDING MATERIALS ASSESSMENT

.1 Any information pertaining to asbestos is furnished by the Contract Administrator as a matter of general information only and is not to be interpreted as descriptive of conditions at locations other than those described therein.

.2 Included in Appendix B is an asbestos survey titled "Hazardous Materials Gap Analysis, City of Winnipeg Archives Building, 380 William Avenue, Winnipeg, Manitoba", and prepared by Tesseract Environmental Consulting Inc., based on their site investigation of October 13, 2023.

.3 The survey provides information on the types and locations of asbestos containing materials and was prepared primarily for the use of the City.

.4 The report, by its nature, cannot reveal all conditions that exist or can occur on the site. The Contractor may use this information to draw his own conclusions therefrom.

1.4 HAZARDOUS MATERIALS TESTING RESULTS

.1 Any information pertaining to the following test results is furnished by the Contract Administrator as a matter of general information only and is not to be interpreted as descriptive of conditions at locations other than those described therein.

.2 Included in Appendix B:

.1 Asbestos Inventory Control, dated July 12, 2024, provided by City of Winnipeg, Assets and Project Management, Municipal Accommodations Division. Six (6) pages total.

.2 Test results from 'Floor Fill Insulation – 2nd Floor', document titled: "XRD, SEM, and Elemental Analysis of One Solid Sample for Bureau Veritas Laboratories, tested by GR Petrology Consultants Inc., dated June 2024. Eight (8) pages total.

.3 The test results provide information on the types and locations of asbestos containing materials and were prepared primarily for the use of the City.

.4 The test results, by their nature, cannot reveal all conditions that exist or can occur on the site. The Contractor may use this information to draw his own conclusions therefrom.

1.5 WINDOW ASSESSMENT REPORT

.1 Any information pertaining to the condition of the existing windows is furnished by the Contract Administrator as a matter of general information only and is not to be interpreted as descriptive of conditions at locations other than those described therein.

.2 Included in Appendix C is a Window Assessment Report, as provided by Yarrow Sash & Door. 22 pages total.

.3 The report provides information on the current status of the existing historical windows and was prepared primarily for the use of the City.

.4 Conditions may have changed since the report was completed, and the Contractor shall confirm existing conditions prior to Bidding.

1.6 DISCLAIMER

.1 Neither the City nor the Contract Administrator assumes any responsibility for the accuracy or completeness of soils data shown, nor for the accuracy or completeness of survey or test information.

END OF SECTION

Part 1 GENERAL

1.1 DIVISION OF WORK

.1 Division of the Work among Subcontractors and Suppliers is solely Contractor's responsibility. Contract Administrator and Owner assume no responsibility to act as an arbiter to establish subcontract limits between Sections or Divisions of the Work. Observe most recent version of Manitoba Trade Definitions.

1.2 SPECIFICATIONS LANGUAGE AND STYLE

.1 These specifications are written in the imperative mood and in streamlined form. The imperative language is directed to Contractor, unless stated otherwise.

.2 Complete sentences by reading "shall", " Contractor shall", "shall be", and similar phrases by inference. Where a colon (:) is used within sentences and phrases, read the words "shall be" by inference.

.3 Fulfill and perform all indicated requirements whether stated imperatively or otherwise.

.4 When used in the context of a Product, read the word “provide” to mean “supply and install to result in a complete installation ready for its intended use”.

1.3 CONTRACT DOCUMENTS FOR CONSTRUCTION PURPOSES

.1 The City, through the Contract Administrator, will supply Contractor with a complete set of Contract Document in electronic form before commencement of the Work. Contractor may print hard copies for construction purposes as required.

1.4 DOCUMENTS AT THE SITE

.1 The Contractor shall maintain a set of drawings on which Contractor shall make any changes to the Work. These drawings shall be called “As-Built Drawings”. As-Built Drawings shall be kept in good order and shall be available to the Contract Administrator and its representatives for review at the Place of the Work. The Contractor shall record on the As-Built Drawings changes in Work as they occur. Keep the following documents at Place of the Work, stored securely and in good order and available to The City and Contract Administrator in hard copy and electronic form:

- .1 Current Contract Documents, including Drawings, Specifications and addenda.
- .2 Change Orders, Change Directives, and Supplementary Instructions.
- .3 Reviewed Shop Drawings, Product data and samples.
- .4 Field test reports and records.
- .5 Construction progress schedule.
- .6 Meeting minutes.

.7 Manufacturer's certifications.

.8 Permits, inspection certificates, and other documents required by authorities having jurisdiction.

.9 Current as-built drawings.

.10 Material Safety Data Sheets (MSDS) for all controlled Products.

.11 COR certification.

.12 Labour and material bond.

.13 Site safety plan.

.14 Daily sign-in sheets.

1.5 EXAMINATION OF THE SITE

.1 Prior to commencing actual construction work, check field conditions, obtain and confirm actual site dimensions, examine surface conditions, etc., as required to ensure correct execution of Work. Notify Contract Administrator in writing, of all matters, which could prejudice proper execution of the Work.

.2 Commencement of construction or any part thereof constitutes acceptance of existing conditions and means dimensions have been considered, verified and are acceptable.

1.6 LAYOUT OF THE WORK

.1 Lay out main lines and levels of the Work in relation to designated reference points and benchmarks.

.2 Protect all stakes and markings from movement or destruction.

1.7 CONTRACTOR'S USE OF PREMISES

.1 Except as otherwise specified, Contractor has use of Place of the Work, restricted to the areas affected by the Work only, from time of Contract award until Substantial Completion of the Work. Refer to Section 01 14 00 – Work Restrictions. If access is required to areas not affected by the Work, permission must be obtained from The City in writing prior to access.

.2 Confine Construction Equipment, Temporary Work, storage of Products, waste products and debris, and all other construction operations to limits required by laws, ordinances, permits, and Contract Documents, whichever is most restrictive. Do not unreasonably encumber Place of the Work.

.3 Encroachment of area beyond property lines is to be separately arranged for with municipal authorities and adjacent property owners.

.4 Obtain consent of adjoining property owners regarding the need for any temporary easements or any other encroachment. Upon completion of Contract, remove any encroachments and make good any damage to adjacent property.

.5 Work on city property to be done to City of Winnipeg standards, minimum, unless noted otherwise.

1.8 EXISTING SERVICES

.1 Notify, Contract Administrator, The City, and utility companies of intended interruption of services and obtain required permission.

.2 Provide alternative routes for personnel, pedestrian, and vehicular traffic.

.3 Establish location and extent of service lines and utilities in area of Work before starting Work. Notify Contract Administrator of findings with a report.

.4 Submit schedule to and obtain approval from Contract Administrator and The City for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.

.5 Provide temporary services to maintain critical building systems.

.6 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.

.7 Where unknown services are encountered, immediately advise Contract Administrator and The City and confirm findings in writing.

.8 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.

.9 Record locations of maintained, re-routed and abandoned service lines.

.10 Construct barriers in accordance with Section 01 56 00 – Temporary Barriers and Enclosures.

1.9 WORK PROGRESS

.1 Construction shall commence immediately upon signing the Contract in accordance with the submitted construction schedule, and shall continue, without interruption or slow-down, until completion of all Work, except as directed in Section 01 14 00 – Work Restrictions, or as otherwise acceptable to The City.

.2 Provide temporary heating and hoarding as required to protect the Work from damage from freezing, and to allow temperature sensitive work to continue without delay.

1.10 SUPERVISION

.1 The appointed representative shall be employed from commencement of the Work, until 30 calendar days after Substantial Performance of the Work, or such other time as agreed.

1.11 INSURANCE

.1 The Contractor is responsible to ensure that all Subcontractors performing the Work of this contract maintain adequate insurance coverage.

.2 In the event of an incident, occurrence or loss that may result in a claim under any of the above policies, including injuries to the public, or loss or damage to the Work, the Contractor shall immediately report the incident, occurrence or loss in writing to The City and the Contract Administrator.

END OF SECTION

Part 1 GENERAL

1.1 RESTRICTIONS OF USE ON PREMISES

.1 Unrestricted use of site until Substantial Performance of the Work.

.2 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

.3 Refer to Section 01 51 00 - Temporary Utilities, Section 01 52 00 - Construction Facilities and Section 01 56 00 - Temporary Barriers and Enclosures, for temporary facilities, access roads and parking areas, traffic regulations, and utilities.

.4 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.

.5 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Contract Administrator.

.6 Ensure that operations conditions of existing work at completion are still the same, equal to or better than that which existed before new work started.

1.2 SECURITY

.1 Contractor is responsible for all additional security and safety of the Work; this includes, but in not limited to, installation of a security fence around the perimeter of the construction zone, coordination of additional security and any costs associated with damage, vandalism or theft in the construction zone. Additional on-site security services must be communicated to and approved in writing by The City.

1.3 ACCESS AND EGRESS

.1 Design, construct, and maintain temporary “access to” and “egress from” Work areas, including, but not limited to, stairs, runways, ramps, ladders, and scaffolding, independent of finish surfaces and in accordance with relevant municipal, provincial, and other regulations.

.2 Ensure “access to” and “egress from” neighboring properties.

END OF SECTION

Part 1 GENERAL

1.1 CASH ALLOWANCES

.1 The Contract Price includes the cash allowances. The scope of work or costs included in such cash allowances shall be as described.

.2 The Contract Price, and not the cash allowances, includes the Contractor's overhead and profit in connection with such cash allowances.

.3 Expenditures under cash allowances shall be authorized by The City through the Contract Administrator.

.4 The value of the work performed under a cash allowance is eligible to be included in progress payments.

1.2 LIMITS

.1 Allowances shall not be exceeded without written authority of The City.

Part 2 CASH ALLOWANCES

2.1 CASH ALLOWANCES

.1 Include in Contract Price a cash allowance in the amount of $250,000.

.2 List of allowances to be covered by amount in 2.1.1:

.1 Foundation inspection services.
.2 Compaction testing services.
.3 Concrete testing.
.4 Asphalt paving inspection and testing services.
.5 Mortar sample testing services.
.6 Firestopping and intumescent coating inspection services.
.7 Manitoba Hydro service.
.8 Telecommunications.
.9 Short circuit/arc flash study services.
.10 Door names and numbers.
.11 Unforeseen hazardous materials.

Part 3 APPENDIX

3.1 EXPENDITURE OF CASH ALLOWANCES

.1 Owner, through Consultant, will provide Contractor with documentation required to permit pricing of a cash allowance item.

.2 Owner, through Consultant, may request Contractor to identify potential Suppliers or Subcontractors, as applicable, and to obtain at least three competitive prices for each cash allowance item.

.3 Owner, through Consultant, may request the Contractor to disclose originals of all bids, quotations, and other price related information received from potential Suppliers or Subcontractors.

.4 Owner, through Consultant, will determine by whom and for what amount each cash allowance item will be performed. Obtain Owner's prior written approval in the form of a Change Order before entering into a subcontract, amending an existing subcontract, or performing own forces Work included in a cash allowance. Upon issuance of the Change Order, the Contractor's responsibilities for a cash allowance item shall be the same as for other Work of the Contract.

END OF SECTION

Part 1 ALTERNATES

1.1 ALTERNATE No. 1, CCTV System

.1 Base bid: Refer to electrical drawings and Section 27 41 13, note the CCTV system equipment including supply amd installation of all interior and exterior cameras, mounts, enclosures, wiring, digital video recorder, storage unit and network tie-in.

.2 Alternate: Delete supply and installation of all CCTV wiring and equipment. In lieu, supply and install rough-in conduit infrastructure for CCTV system installation by others. Refer to electrical drawings and specifications.

1.2 ALTERNATE No. 2, South Elevation Windows, Second Floor & Mezzanine

.1 Base bid: Refer to drawing A4.4 and specifications, and note window rough openings 1-26, 1-27 and 2-15 thru 2-30 (18 windows total) where the window renovations schedule identifies that existing wood-framed windows are to be removed and replaced with new double-hung wood-framed window and sashes to match existing complete with HSDG glazing.

.2 Alternate: Remove existing wood-framed windows in their entirety and in lieu install insulated steel stud infill wall construction within each rough opening, tie into exist masonry. Supply and install interior insulated panels at vault and exterior steel covers as specified in contract.

INTERIOR INSULATED METAL PANELS AS SPECIFIED
5/8” GYPSUM WALLBOARD TYPE ‘X’, PRIMER PNT
6mil POLY VAPOUR BARRIER, CAULK & SEAL TO
MASONRY R.O.
6” STEEL STUDS C/W MINERAL WOOL INSULATION INFILL,
FULL DEPTH OF STUDS
5/8” FIBERGLASS MATT GYPSUM WALLBOARD
AIR INFILTRATION BARRIER
EXTERIOR PRE-FINISHED METAL COVERS AS SPECIFIED

1.3 ALTERNATE No. 3, South Elevation Windows, Basement

.1 Base bid: Refer to drawing A4.4 and specifications, and note window rough openings B-16, B-17, B19, B-23 & B-24 (5 windows total) where the window renovations schedule identifies that existing wood-framed windows are to be restored in situ complete with new wood-framed storm window to match existing.

.2 Alternate: Remove existing wood-framed windows in their entirety and in lieu install insulated steel stud infill wall construction within each rough opening, tie into exist masonry. Supply and install exterior steel covers as specified in contract. Refer to Alternate No.2 for typical infill construction.

END OF SECTION

Part 1 GENERAL

1.1 GENERAL CONDITIONS

.1 If any information included within this section conflicts with the General or Supplementary Conditions of the Contract, then the General and Supplementary Conditions shall overrule this section.

1.2 SCHEDULE OF VALUES

.1 Within 10 days of award, submit for Contract Administrator's review an initial schedule of values. Modify the initial schedule of values if and as requested by Contract Administrator. Obtain Contract Administrator's written acceptance of the initial schedule of values prior to the first application for payment.

.2 The values in the progress claim shall be presented in accordance with Trade sections. The value shown for each trade of the Work shall be the total of: the Subcontract Price, the cost of the General Contractor's work applicable to the section, and the allowance for profit and overhead by the General Contractor.

.3 Together with the first and all subsequent applications for payment, submit updated versions of the schedule of values to indicate the values, to the date of application for payment, of Work performed and Products delivered to Place of the Work.

.4 Provide the schedule of values in an electronic spreadsheet format that provides for inclusion of the following information:

.1 Identifying information including title and location of the Work, name of Contractor, number and date of application for payment, and period covered by the application for payment.

.2 A work breakdown structure based on specification sections breakdown. Include separate line items for closeout procedures including closeout submittals, demonstration and training, start-up and testing, and commissioning, collectively valued at minimum 0.5% of Contract Price.

.3 A separate line item for General Conditions (General Contractor Work and supervision).

.4 Provisions for approved Change Orders and allowances so that the breakdown amounts indicated in the schedule of values aggregate to the current total Contract Price.

.5 For each item in the work breakdown structure, provide as a minimum the following information, under headings as indicated:

.1 Breakdown Amount: A dollar amount, including an appropriate pro rata portion of Contactor's overhead and profit.

.2 Performed to Date: The value of Work performed and Products delivered to Place of the Work up to the date of the application for payment, stated as a percentage of the Contract Price and in dollars.

.3 Previously Performed: The value of Work performed and Products delivered to the Place of the Work for which payment has been previously certified, stated in dollars.

.4 Current Period: The value of Work performed and Products delivered to Place of the Work for which Contractor is currently applying for payment, stated in dollars.

.5 Balance to Complete: The value of Work not yet performed and Products not yet delivered to Place of the Work, stated in dollars.

.5 Applications shall also include a statement as to the amount of GST to be paid by the City, and shall indicate the Contractor's GST Registration Number.

.6 The amount claimed shall be for the value, proportionate to the amount of the Contract, of Work performed at the Place of the Work, and Products delivered to the Place of the Work as of the last day of the payment period.

1.3 CASH FLOW PROJECTION

.1 Prior to the first application for payment, and monthly thereafter, submit, for Contract Administrator's review, a forecast of approximate monthly progress payments for each month of the Contract Time.

.2 Submit revised cash flow forecasts when required due to significant changes in rate of progress of the Work or significant changes in the Contract Price, or when requested by Contract Administrator.

1.4 PAYMENT FOR PRODUCTS STORED OFF SITE

.1 The City may, due to extraordinary circumstances and at The City's sole discretion, make payments for Products delivered to and stored at a location other than Place of the Work, subject to:

.1 a request submitted by Contractor in writing, with appropriate justification, and

.2 whatever conditions The City or Contract Administrator may establish for such payments, as required to protect The City's interests.

END OF SECTION

Part 1 GENERAL

1.1 INTENT

.1 The Contractor shall hold project meetings to provide a forum to ensure the opportunity for adequate and proper job coordination.

1.2 ADMINISTRATIVE

.1 Prepare agenda for meetings.

.2 Distribute written notice of each meeting four (4) days in advance of meeting date to Contract Administrator and the City.

.3 Provide physical space and make arrangements for meetings.

.4 During a health pandemic, special procedures may be required to limit the size of meetings and proximity of participants as Provincially legislated or mandated by Municipal regulations. In the event of conflict between any of the above provisions, the most stringent provisions shall apply.

.5 Provide for a video conferencing platform (ie. Zoom, Skype, or other similar platform).

.6 Preside at meetings.

.7 Record the minutes. Include significant proceedings and decisions. Identify 'action by' parties.

.8 Produce copies of minutes within three (3) days after each meeting and distribute to meeting participants, affected parties not in attendance, and the Contract Administrator team.

.9 Representatives of Contractor, Subcontractors, and suppliers attending meetings shall be qualified and authorized to act on behalf of the party each represents.

Part 2 MEETINGS

2.1 CONSTRUCTION START UP MEETING

.1 Within 10 days after Contract award, establish the time and location of a construction start-up meeting to review and discuss administrative procedures and responsibilities. Notify Contract Administrator and the City at least five (5) Working Days before the meeting.

.2 Senior representatives of the City, Contract Administrators, and Contractor, including Contractor's project manager and site superintendent, and major Subcontractors, shall be in attendance, or by video conference.

.3 Contractor's representative will chair the meeting and record and distribute the minutes.

.4 Agenda will include following:

.1 Appointment of official representatives of the City, Contractor, Subcontractors, and Contract Administrators from each discipline.
.2 Project communications.
.3 Contract Documents for construction purposes.
.4 Documentation: Bonds, Insurances, Workers Compensation Board Clearance, and Building Permit.
.5 Documents at the site.
.6 Criminal record checks.
.7 Contractor's use of premises.
.8 Work restrictions.
.9 Cash allowances.
.10 Contract modification procedures.
.11 Payment procedures.
.12 Construction progress meetings.
.13 Construction progress schedule, including long lead time items.
.14 Submittals schedule and procedures.
.15 Cash flow forecast.
.16 Special procedures.
.17 Quality requirements, including testing and inspection procedures.
.18 Contractor's mobilization.
.19 Temporary utilities.
.20 Existing utility services.
.21 Construction facilities.
.22 Temporary barriers and enclosures.
.23 Temporary controls.
.24 Field engineering and layout of work.
.25 Site safety, COR, safety meetings.
.26 Site security, staging and fencing.
.27 Cleaning and waste management.
.28 Closeout procedures and submittals, record drawings and manuals.
.29 Commissioning.
.30 Other items.

2.2 CONSTRUCTION PROGRESS MEETINGS

.1 As noted in the Contract, schedule regular bi weekly construction progress meetings for the duration of the Work, at times and locations acceptable to the Contract Administrator. Prepare meeting agendas, chair the meetings, and record and distribute the minutes.

.2 Arrange for and provide physical space for meetings.

.3 Record in the meeting minutes significant decisions and identify action items and action dates by attendees or the parties they represent.

.4 Distribute copies of minutes within three (3) Working Days after each meeting to meeting attendees and any affected parties who may not be in attendance.

.5 Ensure that Subcontractors attend, or by video conference, as and when appropriate to the progress of the Work.

.6 Agenda for each meeting shall include the following, as a minimum:

- .1 Approval of minutes of previous meeting.
- .2 Work progress since previous meeting.
- .3 Field observations, including any problems, difficulties, or concerns.
- .4 Construction progress schedule.
- .5 Submittals schedule.
- .6 Proposed changes in the Work.
- .7 Risk registry.
- .8 Requests for information.
- .9 Site safety issues.
- .10 Other business.

.7 Special meetings may be called by the City, Contract Administrator, or Contractor.

END OF SECTION

Part 1 GENERAL

1.1 DETAILED WORK SCHEDULE

.1 Provide as indicated in the Supplementary Conditions to the Contract, and as follows.

.2 Format and Content:

.1 Prepare schedule in the form of a Critical Path Method (CPM) Gantt chart using appropriate scheduling software.

.2 Provide a work breakdown structure identifying key activities, work packages, and major milestones, including long delivery Products, inspection and testing activities, preparation and review of mock-ups, decisions for cash allowances, shutdown or closure activities, demonstration and training activities, and similar items, at a sufficient level of detail to effectively manage construction progress.

.3 Indicate milestone date for Substantial Performance of the Work.

.3 Submission:

.1 Submit schedule via e-mail as .pdf files.

.2 Include copies of letters from all sub-trades and major suppliers, confirming completion dates for their respective trades in the allotted schedule.

.3 Contract Administrator will review format and content of initial schedule and request necessary changes, if any, within 10 Working Days after receipt.

.4 If changes are required, resubmit finalized initial schedule within five (5) Working Days after return of review copy.

1.2 SUBMITTALS SCHEDULE

.1 Format and Content:

.1 Prepare schedule identifying all required Shop Drawing, Product data, and sample submissions, including samples required for testing.

.2 Prepare schedule in electronic format.

.3 Provide a separate line for each required submittal, organized by specifications section names and numbers, and further broken down by individual Products and systems as required.

.4 For each required submittal, show planned earliest date for initial submittal, earliest date for return of reviewed submittal by Contract Administrator, and latest date for return of reviewed submittal without causing delay.

.5 Allow time in schedule for resubmission of submittals, should resubmission be necessary.

.2 Submission:

.1 Submit initial schedule to Contract Administrator within 20 Working Days after Contract award.

.2 Submit schedule via e-mail as .pdf files.

.3 Contract Administrator will review format and content of initial schedule and request necessary changes, if any, within 10 Working Days after receipt.

.4 If changes are required, resubmit finalized schedule within five (5) Working Days after return of review copy.

.5 Submit updated submittals schedule monthly to The City and Contract Administrator.

1.3 SCHEDULE MANAGEMENT

.1 A schedule submitted as specified and accepted by Contract Administrator shall become the baseline schedule and shall be used as the baseline for updates.

.2 At each regular progress meeting, review and discuss current construction progress and submittals schedules with Contract Administrator and The City, including activities that are behind schedule and planned measures to regain schedule slippage in key areas on or near the critical path.

.3 Activities considered behind schedule are those with start or completion dates later than the dates shown on the baseline schedule.

1.4 RECORDING ACTUAL SITE CONDITIONS ON AS-BUILT DRAWINGS

.1 Print a hard copy set of construction Drawings for the purpose of creating as-built drawings. Record information and maintain as-built drawings in clean, dry and legible condition.

.2 Clearly label each drawing as “AS-BUILT DRAWING”. Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

.3 Record actual construction including:

.1 Measured depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.3 Measured locations of pipes, ducts, conduits, outlets, fixtures, access panels, and appurtenances, referenced to visible and accessible features of construction.

.4 Field changes of dimension and detail.

.5 Changes made by Addendum, Change Orders and Supplemental Instructions.

.6 References to Shop Drawings, where Shop Drawings show more detail.

.4 Do not use as-built drawings for construction purposes.

.5 As-Built Drawings shall be kept in good order and shall be available to the City, Contract Administrator and its representative for review at the Place of the Work.

1.5 DAILY SIGN-IN SHEETS

.1 Daily sign-in sheets are to be maintained on site to record the actual times and dates of who is on site, how long they are on site and the trade classification.

.2 Daily sign-in sheets are to be provided to the City upon request.

1.6 DAILY FIELD REPORTS

.1 Daily field reports are to be kept recording the number of tradespeople on site, weather conditions, threats to progress, incidents involving theft or safety, and schedule updates.

.2 Daily field reports are to be provided to the City upon request.

1.7 PHOTOGRAPHIC DOCUMENTATION

.1 Arrange for periodic digital photography to document and provide a photographic record of the progress of the Work.

.2 Preconstruction photographs: take photographs of existing conditions, interior and exterior, of the existing building and site.

.1 Number of viewpoints:

.1 Each side of building.

.2 Interior of rooms and finishes.

.3 Progress photographs:

.1 Viewpoints: Interior and exterior locations of the Work as determined by Contract Administrator. Take photographs of the Work in progress, including the renovation work, and at least one of each type of fire-stopping applied, and as determined by the Contract Administrator, minimum 50 photographs of different conditions per week.

.2 Take photographs of all work that will be concealed with other work prior to concealment.

.3 Provide photographs of corrective measures taken following Site Instructions.

.4 Final photographs:

.1 Number of viewpoints:

.1 Each side of building.

.2 Interior of rooms and finishes.

.3 Completed renovation work, including at least one (1) of each type of fire-stopping applied, and as determined by the Contract Administrator.

.5 Identify each photograph by project name and date taken.

.6 Submit .jpg format files in standard resolution via e-mail.

.7 Do not use progress or any other Project photographs for promotional purposes without The City's written consent.

END OF SECTION

Part 1 GENERAL REQUIREMENTS

1.1 ADMINISTRATIVE

.1 Submit specified submittals to Contract Administrator for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time or for Product substitutions or other deviations from the Drawings and Specifications.

.2 Where required by authorities having jurisdiction, provide submittals to such authorities for review and approval.

.3 Do not proceed with Work affected by a submittal until review is complete.

.4 Present Shop Drawings, Product data, and samples in same units as the construction drawings. Where items or information is not produced in the same units, converted values are acceptable.

.5 Review submittals, provide verified field measurements where applicable, and affix Contractor's review stamp prior to submission to Contract Administrator. Contractor's review stamp represents that necessary requirements have been determined and verified, and that the submittal has been checked and coordinated with requirements of the Work and Contract Documents.

.6 Verify field measurements and that affected adjacent work is coordinated

.7 Submittals not meeting specified requirements will be returned with comments.

.8 Reproduction of construction Drawings to serve as background for Shop Drawings is not permitted.

.9 Do not propose Substitutions or deviations from Contract Documents via Shop Drawing, Product data or sample submittals.

.10 Coordinate each submission with requirements of the Work and Contract Documents. Individual shop drawings will not be reviewed until all related drawings are available.

1.2 CONTRACT ADMINISTRATOR'S REVIEW

.1 The Contract Administrator's review will be for conformity of design concept and for general arrangement only. Such review shall not be considered relief of responsibility for errors or omissions in submittals or of responsibility for meeting all requirements of the Contract Documents, unless a deviation has been approved in writing by the Contract Administrator.

1.3 SUBMISSION REQUIREMENTS

.1 Schedule submissions at least ten (10) days before date reviewed submissions will be needed.

.2 Distribute copies of shop drawings and project data which carry Contract Administrator's stamp to:

.1 Job site file,

.2 Record documents file,

.3 Affected Subcontractors, Sub-subcontractors, suppliers and fabricators.

.3 At the time of submission, advise the Contract Administrator in writing of any deviations in the submission from the requirements of the Contract Documents. Obtain the Contract Administrator's acceptance or rejection of such deviation in writing.

Part 2 SUBMITTALS

2.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Indicate Products, methods of construction, and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of the Work.

.2 Where Products attach or connect to other Products, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross-references to Drawings, Specifications and other already reviewed Shop Drawings.

.3 Accompany submittals with a transmittal information including:

.1 Date.

.2 Project title and number.

.3 Contractor's name and address.

.4 Identification of each submittal item and quantity.

.5 Other pertinent data.

.4 Shop Drawing submittals shall include:

.1 Date and revision dates.

.2 Project title and number.

.3 Name and address of:

.1 Subcontractor.

.2 Supplier.

.3 Manufacturer.

.4 Contractor's stamp, date, and signature of Contractor's authorized representative responsible for Shop Drawing review, indicating that each Shop Drawing has been reviewed for compliance with Contract Documents and, where applicable, that field measurements and field construction conditions have been verified. Shop drawings not stamped, signed and dated shall be returned the Contractor without being examined and shall be considered rejected.

.5 Details of appropriate portions of the Work as applicable:

.1 Fabrication.

.2 Layout, showing dimensions, including identified field dimensions, and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationships to other parts of the Work.

.5 Product data submittals shall include material safety data sheets (MSDS) for all controlled Products.

.6 Submit electronic copy of Shop Drawings in Portable Document Format (PDF) where specified in the technical specifications.

.7 Submit electronic copy of Product data sheet or brochures in Portable Document Format (PDF) where specified in the technical specifications.

.8 Where a submittal includes information not applicable to the Work, clearly identify applicable information and strike out non-applicable information.

.9 Supplement standard information to include details applicable to Project.

.10 Allow 10 Working Days for Contract Administrator's review of each submittal and incorporate in submittals schedule specified in Section 01 32 00 – Construction Progress Documentation. Allow additional five (5) Working Days where sub-Contract Administrator or commissioning agent review is required.

.11 If upon Contract Administrator’s review no errors or omissions are discovered, or if only minor corrections are required as indicated, submittal will be returned and fabrication or installation of Work may proceed.

.12 If upon Contract Administrator’s review significant errors or omissions are discovered, a so noted copy will be returned for correction and resubmission. Do not commence fabrication or installation.

.13 Contract Administrator's notations on submittals are intended to ensure compliance with Contract Documents and are not intended to constitute a change in the Work requiring change to the Contract Price or Contract Time. If Contractor considers any Contract Administrator's notation to be a change in the Work, promptly notify Contract Administrator in writing before proceeding with the Work.

.14 Resubmit corrected submittals through same procedure indicated above, before any fabrication or installation of the Work proceeds. When resubmitting, notify Contract Administrator in writing of any revisions other than those requested by Contract Administrator.

.15 Shop drawings which require approval of any legally constituted authority having jurisdiction shall be provided to such authority by Contractor for approval.

.16 Pay all costs to distribute submissions for Contract Administrator review.

2.2 SAMPLES

.1 Submit samples for Contract Administrator's review in duplicate where specified in the technical specifications. Label samples as to origin, Project name, and intended use.

.2 Deliver samples prepaid to Contract Administrator's business address.

.3 Notify Contract Administrator in writing of any deviations in samples from requirements of Contract Documents.

.4 Where a required colour, pattern or texture has not been specified, submit full range of available Products meeting other specified requirements.

.5 Contract Administrator selection from samples is not intended to change the Contract Price or Contract Time. If a selection would affect the Contract Price or Contract Time, notify Contract Administrator in writing prior to proceeding with the Work.

.6 Resubmit samples as required by Contract Administrator to comply with Contract Documents.

.7 Reviewed and accepted samples will establish the standard against which installed Work will be reviewed.

.8 Pay all costs to distribute physical samples for Contract Administrator review.

END OF SECTION

Part 1 GENERAL

1.1 BUILDING AND SITE SMOKING ENVIRONMENT

.1 The City has a no smoking policy for the entire workplace. No smoking or vaping is allowed on the The City's property.

.2 Smoking or vaping on the premises, including when in vehicles, will not be permitted. This policy applies equally to all staff and Contractor's employees. Contractors are required to bring this policy to the attention of all their employees, subcontractors and suppliers who will be required to work in the building and rigidly enforce this policy.

1.2 RESPECTFUL WORKPLACE

.1 Contractor is to establish Respectful Workplace guidelines and ensure all personnel and Subcontractors follow the guidelines.

1.3 CERTIFICATE OF RECOGNITION (COR)

.1 The Contractor acknowledges it has a current Certificate of Recognition (COR) or a third party audited Safety Accreditation acceptable to Contract Administrator and will maintain this documentation in good standing throughout the term of this Contract.

.2 The Contractor shall take all necessary precautions to ensure partial in place construction is adequately braced against movement and that all hazardous areas are protected to prevent injury or damage to property.

.3 The Contractor shall be entirely responsible for safety of Work during construction.

.4 The Contractor shall execute the Work and provide protection of personnel, occupants, public and property in conformance with the most stringent requirements and regulations of all local codes and by-laws including the Manitoba Building Code, WHMIS and be responsible for obtaining all permits.

.5 The Contractor shall provide prior to commencing Work a detailed Site Safety Plan pertaining to fall protection, scaffolding and confined space entry, including provision for rescue and emergency.

1.4 RESPONSIBILITY

.1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

.2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, COR and with site-specific Health and Safety Plan.

1.5 UNFORSEEN HAZARDS

.1 When unforeseen or peculiar safety-related factors, hazards, or conditions occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Contract Administrator verbally and in writing.

1.6 POSTING OF DOCUMENTS

.1 Ensure applicable items, articles, notices and orders are posted in a conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Contract Administrator.

.2 Labour & Material Payment Bond must be posted and available to Subcontractors.

1.7 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction, The City, or by Contract Administrator.

.2 Provide Contract Administrator with written report of action taken to correct non-compliance of health and safety issues identified.

.3 The City or Contract Administrator may stop Work if non-compliance of health and safety regulations is not corrected.

1.8 WORK STOPPAGE

.1 If Work stoppage is required due to any of the following reasons, this shall have precedence over cost and schedule considerations for Work.

- .1 Safety and health of public and site personnel and protection of environment;
- .2 Failure to comply with workers' compensation regulations;
- .3 Using unlicensed contractors;
- .4 Violating environmental protection laws or use of hazardous materials at the construction site;
- .5 Failure to follow the Occupational Health and Safety Act; or
- .6 Any other activity considered illegal according to the regulations.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 "Reference standards" means consensus standards, trade association standards, guides, and other publications expressly referenced in Contract Documents.

.2 Where an edition or version date is not specified, referenced standards shall be deemed to be the latest edition or revision issued by the publisher at the time of bid closing. However if a particular edition or revision date of a specified standard is referenced in an applicable code or other regulatory requirement, the regulatory referenced edition or version shall apply.

.3 Reference standards establish minimum requirements. If Contract Documents call for requirements that differ from a referenced standard, the more stringent requirements shall govern.

.4 If compliance with two or more reference standards is specified and the standards establish different or conflicting requirements, comply with the most stringent requirement. Refer uncertainties to Contract Administrator for clarification.

.5 Within the Specifications, reference may be made to the following standards writing, testing, or certification organizations by their acronyms or initialisms:

.1 AA - Aluminum Association
.2 ACI - American Concrete Institute
.3 AISC - American Institute of Steel Construction
.4 ANSI - American National Standards Institute
.5 ASME - American Society of Mechanical Engineers
.6 ASTM - American Society for Testing and Materials
.7 AWMAC - Architectural Woodwork Manufacturers Association of Canada
.8 CGSB - Canadian General Standards Board
.9 CISC - Canadian Institute of Steel Construction
.10 CSA - Canadian Standards Association
.11 CSSBI - Canadian Sheet Steel Building Institute
.12 CWB – Canadian Welding Bureau
.13 ICEA - Insulated Cable Engineers Association
.14 IEEE - Institute of Electrical and Electronics Engineers
.15 MPP – Master Painters Institute
.16 MSS - Manufacturers Standardization Society of the Valve and Fittings Industry
.17 NAAMM - National Association of Architectural Metal Manufacturers
.18 NEMA - National Electrical Manufacturers Association
.19 NFPA - National Fire Protection Association

.20 NHLA - National Hardwood Lumber Association

.21 NLGA - National Lumber Grades Authority

.22 SSPC – The Society for Protective Coatings

.23 TTMAC - Terrazzo, Tile and Marble Association of Canada

.24 ULC - Underwriters' Laboratories of Canada

1.2 INDEPENDENT INSPECTION AND TESTING AGENCIES

.1 Except as otherwise specified, The City will retain and pay for independent inspection and testing agencies to inspect, test, or perform other quality control reviews of parts of the Work.

.2 Retain and pay for inspection and testing as follows:

.1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities

.2 Inspection and testing performed exclusively for Contractor's convenience

.3 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems

.4 Mill tests and certificates of compliance

.5 Tests specified to be carried out by Contractor under the supervision of Contract Administrator

.6 Additional tests where tests or inspections by designated testing agent reveal Work not in accordance with Contract requirements, as Contract Administrator may require to verify acceptability of corrected Work.

.3 Section 01 21 00 – Allowances specifies a cash allowance for independent inspection and testing services to be retained and paid for by Contractor. Cash allowance excludes any inspection and testing that is for Contractor’s own quality control or is required by regulatory requirements.

.4 Employment of inspection and testing agencies by Contractor or The City does not relieve Contractor from responsibility to perform the Work in accordance with Contract Documents.

.5 For inspection and testing required by Contract Documents or by authorities having jurisdiction, provide Contract Administrator and inspection and testing agencies with timely notification in advance of required inspection and testing.

1.3 CONTRACTOR’S RESPONSIBILITIES

.1 Allow and arrange for inspection and testing agencies to have access to the Work, including access to offsite manufacturing and fabrication plants.

.2 Furnish labour and facilities to:

.1 Provide access to Work to be inspected and tested,

.2 Facilitate inspections and tests,

.3 Make good work disturbed by inspection and testing.

.3 Submit test samples required for testing in accordance with submittals schedule specified in Section 01 32 00 – Construction Progress Documentation.

.4 Provide labour, Construction Equipment and temporary facilities to obtain and handle test samples on site.

.5 Provide heating and hoarding when required if testing is to be done in inclement weather conditions. For testing window leakage, provide heating and hoarding to maintain 5°C for 3 hours prior to and 8 hours after completion of testing.

.6 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and accepted by Contract Administrator.

1.4 INSPECTION AND TESTING AGENCY REPORTS

.1 For inspection and testing required by Contract Documents or by regulatory requirements, and performed by Contractor retained inspection and testing agencies, submit to Contract Administrator and the City copies of reports. Submit within five (5) Working days after completion of inspection and testing.

.2 For inspection and testing performed by The City retained inspection and testing agencies, copies of inspection and testing agency reports will be provided to Contractor.

1.5 MOCK-UPS

.1 Prepare mock-ups of Work as specified in the technical specifications. If a mock-up location is not indicated in the Drawings or Specifications, locate where directed by Contract Administrator.

.2 Notify Contract Administrator in writing of any deviations in mock-up from requirements of Contract Documents.

.3 Modify mock-up as required until Contract Administrator approval is obtained.

.4 Approved mock-ups establish an acceptable standard for the Work.

.5 Protect mock-ups from damage until the Work they represent is complete.

.6 Unless otherwise specified in the technical specifications, approved mock-ups forming part of the Work may remain as part of the Work.

.7 Remove mock-ups only when the Work they represent is complete or when otherwise directed by Contract Administrator.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 This Section includes regulatory requirements applicable to the Contract Documents and the Project and Work. This section shall cover the general requirements for regulatory requirements pertaining to the Work and is supplementary to all other regulatory requirements mentioned or referenced elsewhere in the Contract Documents.

.2 The applicable edition of all codes shall be that currently adopted at the time of issuance of permits by the authority having jurisdiction and shall include all modifications and additions adopted by that authority.

.3 The applicable date of laws and ordinances shall be that of the date of performance of the Work affected by such laws and ordinances.

.4 Specific reference in the Specifications to codes and regulations or to requirements of regulatory agencies shall mean the latest edition of each adopted by the regulatory agency in effect at the time of issuance of permits.

.5 All materials, installation, and construction shall comply with the applicable provisions of current laws, codes, safety rules, and regulations of local, federal and any other applicable authorities (“Codes”).

.6 Codes referenced in the Contract Documents shall have full force and effect as though set out in full in these Specifications. Nothing in the Contract shall be construed to permit Work not conforming to applicable Code requirements.

.7 The Codes and other authorities referenced in the Contract Documents are not a comprehensive list of all Codes applicable to the Work; the Codes listed in the Contract Documents are referenced for the information and convenience of the Contractor only. The Contract Administrator does not represent that all Codes applicable to the Work have been cited or adequately described in the Contract Documents. Contractor is solely responsible for compliance with all Codes applicable to the Work and relevant to the Contractor's means and methods of performing said Work.

1.2 REFERENCES TO REGULATORY REQUIREMENTS

.1 General: References to codes, standards or regulatory requirements made on Drawings or in Specifications are considered an integral part of Contract Documents as minimum requirements.

.2 All statutes, ordinances, laws, rules, codes, regulations, standards, and lawful orders of all public authorities have jurisdiction of the Work, are hereby incorporated into these Contract Documents as if repeated in full herein and are intended to be included in any reference to Code or Building Code, unless otherwise specified, including, without limitation, any of the references specified in this section.

.3 Referenced Codes, laws, ordinances, rules and regulations shall have full force and effect as though printed in full in these Specifications. Contractor is assumed to be and shall be familiar with these requirements, including having readily available access to these requirements.

.4 References on the Drawings or in the Specifications to "code", "Code" or "building code" similar terms, not otherwise identified, shall mean the codes indicated above in .2 together with all additions, amendments, changes, and interpretations adopted by code authorities of the jurisdiction having authority over the Project.

.5 Contractor shall conform to all applicable federal, provincial, and local codes, laws, ordinances, rules and regulations, whether or not referenced in the Contract Documents. Compliance with applicable regulatory requirements is the responsibility of the Contractor.

1.3 PRECEDENCE

.1 Where requirements differ from the requirements of applicable codes, ordinances, standards, and the authority having jurisdiction, the more stringent requirements shall take precedence with no change in Contract Sum or Contract Time.

.2 Where Contract Documents require or describe Products or execution of better quality, higher standard or greater size than required by applicable codes, ordinances and standards, Contract Documents shall take precedence so long as such increase is legal.

.3 Where no requirements are identified on Contract Documents, comply with all requirements of applicable codes, ordinances and standards of governing authorities have jurisdiction.

1.4 CODES

.1 Applicable Codes: The codes that apply to this Project include, but are not limited to, the currently adopted editions of the following. Comply with Codes in effect at the time of issuance of permits.

.1 MBC – Manitoba Building Code.

.2 MPC – Manitoba Plumbing Code.

.3 MFC – Manitoba Fire Code.

.4 MECB – Manitoba Energy Code for Buildings

.5 MEC – Manitoba Electrical Code

.6 All local codes including amendments to the preceding listed codes.

.2 Application of the Codes:

.1 Whenever there is a conflict between general and specific requirements in the code, the specific requirements shall be followed.

.2 Where differences exist between codes affecting this Work, the code affording the greatest protection shall govern.

.3 Where codes other than those listed in this Section are referred to in the different sections of the Specifications, it is understood that they apply fully as if cited herein.

.4 All Work performed shall be in accordance with applicable codes; a copy of each shall be kept at the jobsite.

.5 If Contractor observes that the Drawings and Specifications are at variance with the codes, he or she shall notify the Contract Administrator, in writing, at once.

1.5 INDUSTRY STANDARDS

.1 Application:

.1 The industry standards applicable to the Work are indicated in appropriate individual sections of these Specifications, either by their names and the names of the trade associations, government agencies or other producers of standards, or by well-recognized abbreviations thereof.

.1 Refer questions on the meaning of abbreviated designations to the Contract Administrator for clarification before proceeding with Work affected thereby.

.2 Comply with standards in effect at the date of these Contract Documents, except where a standard or specific date or edition is indicated.

.2 Any material specified by reference to the number, symbol, or title of a specific standard, such as Commercial Standard, Federal Specifications, American Society for Testing Materials, a trade association standard, or other similar standard, shall comply with the requirements in the latest revision thereof and any amendments or supplements thereto in effect on the date of Contract Documents.

.3 The standard referred to, except as modified in the Contract Documents, shall have full force and effect as though printed in these Specifications.

.4 These standards are not furnished to Contractor since manufacturers and trades involved are assumed to be familiar with their requirements. Where copies of standards are needed for proper performance of the Work, the Contractor shall obtain such copies which shall be maintained at the jobsite by the Contractor and made available for review on request by the Contract Administrator.

.5 Where referenced standard Specifications require weather protection, it shall be provided by the Contractor at no additional cost to the City and shall be deemed necessary in order to construct the Project within the specified time period.

1.6 APPLICABLE LAWS, ORDINANCES, AND REGULATIONS

.1 Work shall be accomplished in conformance with all applicable laws, ordinances, rules and regulations of federal, provincial, and local governmental agencies and jurisdictions having authority over the Project.

.2 Work shall be accomplished in conformance with all rules and regulations of public utilities and utility districts.

.3 Where such laws, ordinances, rules and regulations require more care or greater time to accomplish Work, or require better quality, higher standards or greater size of Products, Work shall be accomplished in conformance to such requirements with no change to the Contract Time and Contract Sum, except where changes in laws, ordinances, rules and regulations occur subsequent to time of issuance of permits.

.4 No Change Order shall be considered for any change in any applicable federal, provincial or local code or regulation if similar language existed in an alternate applicable regulation in force at the time of issuance of permits.

.5 Contractor shall not allow design or construction of any conditions wherein the finished Work will not comply with current applicable codes. No Change Order shall be considered for the Work correction of any Work not complying with code.

END OF SECTION

Part 1 GENERAL

1.1 TEMPORARY UTILITES GENERAL

.1 Provide temporary utilities as specified and as otherwise necessary to perform the Work expeditiously.

.2 Remove temporary utilities after use.

.3 "Provide" means arrange and pay for associated items.

1.2 TEMPORARY WATER SUPPLY

.1 Connect to and use The City's existing water supply for temporary use during construction, subject to existing available volume and pressure. Usage at no cost to Contractor.

.2 Provide necessary water supply connections and disconnections.

1.3 TEMPORARY HEATING AND VENTILATION

.1 Contractor may connect to and use The City's existing supply for temporary use during construction, subject to existing available volume and pressure. Usage at no cost to Contractor.

.2 Vent construction heaters in enclosed spaces to the outside or use flameless type of construction heaters.

.3 Provide temporary heat for the Work as required to:

.1 Facilitate progress of Work.

.2 Protect the Work against dampness and cold.

.3 Prevent moisture condensation on surfaces, freezing, or other damage to finishes or stored Products.

.4 Maintain specified minimum ambient temperatures and humidity levels for storage, installation and curing of Products.

.5 After building is enclosed, maintain interior temperature of minimum 10 degrees C.

.4 Provide temporary heat as required to maintain temperatures of minimum 20 degrees C in all occupied areas affected by the Work.

.5 Provide temporary ventilation for the Work as required to:

.1 Prevent accumulations of fumes, exhaust, vapours, gases and other hazardous, noxious, or volatile substances in enclosed spaces, as required to maintain a safe work environment meeting applicable regulatory requirements.

.2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.

.3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.

.4 Ventilate temporary sanitary facilities.

.6 New permanent building heating and ventilation systems may be used during construction, at Contractor's option. If used during construction:

.1 Before systems are put into use, Mechanical Contract Administrator must perform an inspection of the system and approve use in writing.

.2 The City will pay utility costs resulting from the use of permanent systems.

.3 Operate systems in a non-wasteful and energy efficient manner. Be responsible for any system damage.

.4 Just prior to Substantial Performance of the Work, replace filters, clean and perform other required maintenance to ensure systems are in as near as new condition as possible.

.5 Ensure that systems manufacturers' warranties do not commence until the date of Substantial Performance of the Work or, if manufacturers' warranties do commence earlier when systems are put into use, arrange for necessary extension of manufacturers' warranties or provide equivalent coverage under Contractor's warranty.

1.4 TEMPORARY ELECTRICAL POWER AND LIGHTING

.1 Connect to and use The City's existing electrical supply for temporary use during construction. Contractor is responsible to determine if electrical supply can support usage. Usage at no cost to Contractor.

.2 Arrange and pay for necessary connections and disconnections of temporary power and lighting in accordance with regulatory requirements.

.3 New permanent building power and lighting systems may be used during construction, at Contractor's option. If used during construction:

.1 The City will pay utility costs resulting from the use of permanent systems.

.2 Operate systems in a non-wasteful and energy efficient manner. Be responsible for any system damage.

.3 Just prior to Substantial Performance of the Work, replace lamps which have been used for more than 3 months.

.4 Ensure that systems manufacturers' warranties do not commence until the date of Substantial Performance of the Work or, if manufacturers' warranties do commence earlier when systems are put into use, arrange for necessary extension of manufacturers' warranties or provide equivalent coverage under Contractor's warranty.

1.5 SITE LIGHTING

.1 Arrange and pay for temporary site lighting for nighttime hours during construction, to discourage vandalism and theft. Install lamps in suitable locations to obtain unobstructed light over the entire site.

.2 Perform daily inspection of all temporary lighting and replace any burnt-out, missing or damaged lamps. Relocate promptly any lights that become obstructed by new Work.

END OF SECTION

Part 1 GENERAL

1.1 CONSTRUCTION FACILITIES GENERAL

.1 Provide temporary construction facilities as necessary for performance of the Work and in compliance with applicable regulatory requirements.

.2 Field offices, sheds, storage and other temporary facilities shall be located in areas acceptable to the Contract Administrator and the City.

.3 Maintain temporary construction facilities in good condition for the duration of the Work.

.4 Remove temporary construction facilities from Place of the Work when no longer required.

1.2 CONTRACTOR'S OFFICE

.1 Provide and maintain in a clean condition, for the entire progress of the Work, a suitable temperature controlled and ventilated office, with suitable lighting, of sufficient size to accommodate site meetings.

.2 Furnish office to allow for proper filing and examination of Contract Documents and regulatory documents.

.3 Furnish office with a table and chairs to accommodate required persons for site meetings. Space shall be such that there will be no interference or conflict with Contractor's daily office usage.

1.3 OFFICES WITHIN BUILDING

.1 When usable space is available within the project building proper, and if acceptable to the Contract Administrator and the City, the Contractor's office may be located within the building.

.2 Such areas may be used contingent upon there being no delay in completion of the Work and there being no damages to new materials or finishes.

1.4 SUBCONTRACTORS OFFICES

.1 Subcontractors are to provide themselves with office space as necessary, located as directed by General Contractor.

1.5 EQUIPMENT AND TOOL STORAGE

.1 Provide and maintain, in a clean and orderly condition, adequate lockable storage spaces for tools and equipment.

1.6 MATERIALS STORAGE

.1 Provide and maintain, in a clean and orderly condition, suitable space for storage and protection of materials, which require such protection.

1.7 CONSTRUCTION PARKING

.1 Limited parking may be available at Place of the Work.

.2 Do not allow workers to park on streets if disruptive to public traffic flow or access to site.

1.8 VEHICULAR ACCESS

.1 Provide and maintain adequate access to Place of the Work, including access roads, sidewalk crossings, ramps and construction runways as may be required by workers for access to and on site.

.2 Conform to requirements of governing authorities when required, and when necessary make arrangements with adjacent property owners.

.3 Existing roads at Place of the Work may be used for access to Place of the Work, provided Contractor assumes responsibility for any damage caused by construction traffic, and prevents or promptly cleans up any mud tracking or material spillage.

.4 Repair damage to site resulting from construction traffic and temporary facilities to original condition or better. Damaged grassed areas shall be replaced with new sodding. Seeding shall not be acceptable.

1.9 SANITARY FACILITIES

.1 Provide sanitary facilities for workers.

.2 Hand washing facilities to be compliant with 4.9(1) and 4.9(2) of the Workplace Safety and Health Regulation.

.3 Do not use existing or new washroom facilities during construction, unless acceptable to the City.

.4 Keep sanitary facilities clean and fully stocked with the necessary supplies.

1.10 FIRE PROTECTION

.1 Provide and maintain temporary fire protection systems and equipment during construction.

.2 Provide fire watches when necessary and as further described in other specification sections. Consult with Office of the Fire Commissioner as required.

.3 Notify emergency services if ingress and egress through front entrance(s) is changed or not available.

.4 Handle gasoline and like combustible materials with good, safe practice.

1.11 SCAFFOLDING

.1 Provide and maintain adequate scaffolding as may be required for workers. Scaffolding is to be rigid, secure and constructed to ensure proper safety for workers and erected and maintained and in full compliance with Provincial codes or regulations governing scaffolding. Erect scaffolding without any damage to building or finishes.

.2 Scaffolding shall be in accordance with CAN/CSA S269.2.

1.12 CONSTRUCTION STAIRS

.1 Provide, for the use of workers, the Contract Administrator and any other person authorized to be on the site, access stairs from floor to floor, the full height of the Work, as may be required.

.2 Stairs shall be constructed and maintained in full compliance with M.B.C., Safety Code and any other regulation or code governing construction stairs.

Part 2 CONSTRUCTION EQUIPMENT

2.1 EXPLOSIVE ACTUATED FASTENING TOOLS

.1 Provide for the use of explosive actuated fastening tools when required. Conform to the requirements of local governing authorities.

.2 These tools are to be used by persons possessing operator's certificate indicating that they are qualified to use such tools.

2.2 FUELED WELDING MACHINES AND AIR COMPRESSORS

.1 Fueled welding machines and air compressors required for performance of the Work are to be the responsibility of the respective users. Locate outside of building where directed by the Contractor.

2.3 GAS WELDING APPARATUS

.1 Gas welding apparatus required for performance of the Work is the responsibility of the respective users. Ensure apparatus is not open to physical damage and extremes of heat, and is securely anchored to a stable hand truck.

2.4 SELF-PROPELLED ARTICULATING BOOMS

.1 Self-propelled articulating booms required for performance of the Work are the responsibility of the respective users. Ensure equipment is undamaged and in good operating condition, and is operated by licensed operators.

END OF SECTION

Part 1 GENERAL

1.1 BARRIERS AND ENCLOSURES - GENERAL

.1 Provide temporary barriers and enclosures necessary to protect the public and to secure Place of the Work during performance of the Work.

.2 Comply with applicable regulatory requirements.

.3 Maintain temporary barriers and enclosures in good condition for the duration of the Work.

.4 Remove temporary barriers and enclosures from Place of the Work when no longer required, and make good damaged surfaces.

1.2 FENCING

.1 Provide barricades around the construction site (on the construction side of the existing traffic routes) to protect the public and prevent access to the construction site. Barrier shall conform to the requirements of the authorities having jurisdiction.

.2 Provide lockable access gates as required to facilitate construction access.

1.3 WEATHER ENCLOSURES

.1 Provide weather tight enclosures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.

.2 Provide weather enclosures to protect floor areas where walls are not finished and to enclose work areas that require temporary heating.

.3 Design weather enclosures to withstand wind pressure and snow loading requirements.

1.4 EMERGENCY ACCESS ROUTES

.1 Maintain emergency access routes, including overhead clearances, for use by emergency response vehicles.

1.5 PROTECTION OF BUILDING FINISHES

.1 Provide necessary temporary barriers and enclosures to protect existing and completed or partially completed finished surfaces from damage during performance of the Work.

.2 Contractor would be responsible for damages incurred due to lack of or improper or inappropriate protection.

1.6 GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.

.2 Provide secure, rigid guard rails and barricades around doors to prevent public entering the Work site.

1.7 PUBLIC TRAFFIC FLOW

.1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public.

.2 Where required, maintain accessible access to public or tenants.

.3 Maintain ingress and egress of neighbouring properties where affected by Work of the Project.

1.8 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding private and public property from damage during performance of Work.

.2 Be responsible for damage incurred.

END OF SECTION

Part 1 GENERAL

1.1 TEMPORARY CONTROLS - GENERAL

.1 Provide temporary controls as necessary for performance of the Work and in compliance with applicable regulatory requirements.

.2 Maintain temporary controls in good condition for the duration of the Work.

.3 Remove temporary controls and Construction Equipment used to provide temporary controls from Place of the Work when no longer required.

1.2 PLANT PROTECTION

.1 All possible care shall be taken to avoid damage to existing trees.

.2 Where protection of existing trees and plants cannot be maintained, do not proceed with Work without consulting Contract Administrator and The City.

1.3 DUST AND PARTICULATE CONTROL

.1 Implement and maintain dust and particulate control measures in accordance with applicable regulatory requirements.

.2 Execute Work by methods that minimize dust from construction operations and spreading of dust on site or to adjacent properties.

.3 Provide temporary enclosures to prevent extraneous materials resulting from sandblasting or similar operations from contaminating air beyond immediate work area.

.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

.5 Use appropriate covers on trucks hauling fine, dusty, or loose materials.

1.4 DEWATERING

.1 Provide temporary drainage and pumping as necessary to dewater excavations, trenches, foundations, and other parts of the Work. Maintain such areas free of water arising from groundwater or surface run-off, as required to keep them stable, dry, and protected from damage due to flooding.

.2 Maintain standby equipment necessary to ensure continuous operation of dewatering system.

.3 Do not pump water containing suspended materials or other harmful substances into waterways, sewers or surface drainage systems. Treat or dispose of such water in accordance with applicable regulatory requirements.

1.5 SITE DRAINAGE

.1 Maintain grades to ensure proper site drainage.

.2 Prevent precipitation from infiltrating or from directly running off stockpiled materials. Cover stockpiled materials with an impermeable liner during periods of work stoppage including at end of each Working Day.

.3 Control surface drainage from cuts and fills, from borrow and waste disposal areas, from stockpiles, staging areas, and other work areas as required to prevent erosion and sedimentation.

.4 Control surface drainage by ensuring that gutters are kept open and water is not directed across or over pavements or sidewalks, except through pipes or properly constructed troughs. Ensure that runoff from unfinished areas is intercepted and diverted to suitable outlets.

1.6 EROSION AND SEDIMENT CONTROL

.1 Minimize amount of bare soil exposed at one time. Stabilize disturbed soils as quickly as practical to minimize erosion. Remove accumulated sediment resulting from construction activity from adjoining surfaces, drainage systems, and watercourses, and repair damage caused by soil erosion and sedimentation.

.2 Provide and maintain appropriate temporary measures such as silt fences, straw bales, ditches, geotextiles, drains, berms, terracing, riprap, temporary drainage piping, sedimentation basins, vegetative cover, dikes, and other measures that may be required to prevent erosion and migration of silt, mud, sediment, and other debris.

.3 Do not disturb existing embankments or embankment protection.

.4 Periodically inspect erosion and sediment control measures to detect evidence of erosion and sedimentation. Promptly take corrective measures when necessary.

.5 If soil and debris from site accumulate in ditches or other low areas, remove accumulation and restore area to original condition.

1.7 POLLUTION CONTROL

.1 Take measures to prevent contamination of soil, water, and atmosphere through uncontrolled discharge of noxious or toxic substances and other pollutants, potentially causing environmental damage.

.2 Be prepared, by maintaining appropriate materials, equipment, and trained personnel on site, to intercept, clean up, and dispose of spills or releases that may occur.

.3 Promptly report spills and releases that may occur to:

.1 authority having jurisdiction,

.2 person causing or having control of pollution source, if known, and

.3 The City and Contract Administrator.

.4 Contact manufacturer of pollutant, if known and applicable, to obtain material safety data sheets (MSDS) and ascertain hazards involved and precautions and measures required in cleanup or mitigating actions.

.5 Take immediate action to contain and mitigate harmful effects of the spill or release.

1.8 BRACING

.1 Brace the structure in all directions to safely withstand all lateral forces, which may be encountered during erection. The bracing shall remain in place until all walls and structural members, with roof deck, are in place.

1.9 PROTECTION FOR EXISTING BUILDINGS, OFF-SITE AND PUBLIC PROPERTY

.1 Protect existing buildings, and adjacent private and public property from damage during performance of Work.

.2 During excavation, provide sheeting, piling or shoring as may be required to protect adjacent building foundations, utilities and streets from movement.

.3 Be responsible for all damages incurred due to improper protection.

1.10 ROOF PROTECTION

.1 Enforce roof protection procedures and inform all subtrades what they need to do to conform to these procedures. Contractor shall be held liable for all costs to repair damages as a result of failure to enforce the roof protection plan.

.2 Where hoisting occurs adjacent to building surfaces, hang tarpaulins to protect walls and other surfaces.

.3 Provide protective covering consisting of 19mm (3/4”) thick plywood underlaid with 25mm (1”) thick polystyrene insulation board adhered to same, below hoist rigs, ladders, pallets of material, and in other circumstances where roofing membrane is exposed to potential damage.

.4 Roof Installer: at start of roofing system installation, institute appropriate procedures working with General Contractor and Roof Contract Administrator/inspection agency for surveillance and protection of completed roof during remainder of construction period until project is turned over to The City.

.5 General Contractor/Roof Installer: at Substantial Performance of the Work, make final inspections of roofing system, and complete ALL punch lists. Submit confirmation of completed punch lists to Contractor and Contract Administrator/inspection agency.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 Within text of each Specifications section, reference may be made to reference standards.

.2 Conform to these reference standards, in whole or in part as specifically requested in Specifications.

.3 If there is question as to whether Products or systems are in conformance with applicable standards, Contract Administrator reserves right to have such Products or systems tested to prove or disprove conformance.

.4 Cost for such testing will be born by the City in event of conformance with Contract Documents or by Contractor in event of non-conformance.

.5 For Products specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

.6 Conform to reference standard by date of issue current on date of Contract Documents, except where a specific date is established or required by code.

.7 Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Contract Administrator shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.2 GENERAL

.1 Provide Products that are new, not damaged or defective, of specified design and quality, performing to published ratings, suitable for purpose intended, and for which replacement parts are readily available subject to specified requirements. If requested by Contract Administrator, furnish evidence as to type, source and quality of Products provided.

.2 When material or equipment is specified by standard of performance specification, upon request of Contract Administrator, obtain from manufacturer an independent testing laboratory report, stating that material or equipment meets or exceeds specified requirements.

.3 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of Work.

.4 Defective materials, equipment and articles whenever found, will be rejected, regardless of previous inspections. Reviews by the Contract Administrator does not relieve responsibility but is merely a precaution against oversight or error. Remove and replace defective materials at own expense and be responsible for all unnecessary delays and expenses caused by rejection.

.5 Should any dispute arise as to the quality or fitness of materials, equipment or articles, the decision rests strictly with the Contract Administrator based upon the requirements of the Contract Documents.

.6 Unless otherwise specified, maintain uniformity of manufacture for like items throughout.

.7 Permanent manufacturer's markings, labels, trademarks, and nameplates on Products are not acceptable in prominent locations, except where required by regulatory requirements or for operating instructions, or when located in mechanical or electrical rooms.

.8 All equipment required to be C.S.A. approved shall carry the C.S.A. label or C.S.A. testing laboratory listing.

.9 All materials, equipment and fixtures required to be fire rated, shall carry the ULC label or ULC testing laboratory listing.

1.3 IMPERIAL SIZE MATERIALS

.1 Availability:

.1 At the time of construction of the various building elements, certain materials and equipment may not be available in imperial sizes, but only in metric sizes.

.2 Contractor is cautioned to check the availability of imperial sized materials with sub-trades and where metric sizes would cause incompatibility affecting the Work, to make adjustments as may be required to make the several parts of the Work come together.

.2 Costs: there shall be no additional cost to the City resulting from this requirement.

.3 Review:

.1 The Contractor, upon award of the Contract, shall review the Work affected with the Contract Administrator.

.2 This review shall occur at first job progress meeting (refer to Section 01 31 19 – Project Meetings).

.3 Contract Administrator will endeavor to provide additional instruction or clarification as may be required.

1.4 PRODUCT OPTIONS

.1 Unless a product is accepted by the Contract Administrator in writing as an approved equal product, then:

.1 Wherever a Product or manufacturer is specified by a single proprietary name, provide the named Product only.

.2 Wherever more than one Product or manufacturer is specified by proprietary name for a single application, provide any one of the named Products.

.2 Wherever a Product is specified by reference to a standard only, provide any Product that meets or exceeds the specified standard. If requested by Contract Administrator, submit information verifying that the proposed Product meets or exceeds the specified standard.

.3 Wherever a Product is specified by descriptive or performance requirements only, provide any Product that meets or exceeds the specified requirements. If requested by Contract Administrator, submit information verifying that the proposed Product meets or exceeds the specified requirements.

1.5 PRODUCT AVAILABILITY AND DELIVERY TIMES

.1 Promptly upon Contract award and periodically during construction, review and confirm Product availability and delivery times. Order Products in sufficient time to meet the construction progress schedule and the Contract Time, and provide confirmation of orders upon request.

.2 If a specified Product is no longer available, promptly notify Contract Administrator. Contract Administrator will take action as required.

.3 If delivery delays are foreseeable, for any reason, promptly notify Contract Administrator and The City.

.1 If a delivery delay is beyond Contractor's control, Contract Administrator will provide direction.

.2 If a delivery delay is caused by something that was or is within Contractor's control, Contractor shall propose actions to maintain the construction progress schedule for Contract Administrator's review and acceptance.

.4 In the event of failure to notify the Contract Administrator at commencement of Work and should it subsequently appear that Work may be delayed for such reason, the Contract Administrator reserves the right to substitute more readily available products of a similar character at no increase in Contract Price.

1.6 STORAGE, HANDLING, AND PROTECTION

.1 Store, handle, and protect Products during transportation to Place of the Work and before, during, and after installation in a manner to prevent damage, adulteration, deterioration and soiling.

.2 Comply with manufacturer's instructions for storage, handling and protection.

.3 Store packaged or bundled Products in original and undamaged condition with manufacturer's seals and labels intact. Do not remove from packaging or bundling until required in Work.

.4 Comply with the requirements of the workplace hazardous materials information system (WHMIS) regarding use, handling, storage, and disposal of hazardous materials, including requirements for labeling and the provision of material safety data sheets (MSDS).

.5 Store Products subject to damage from weather in weatherproof enclosures.

.6 Store cementitious materials clear of earth or concrete floors, and away from walls.

.7 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

.8 Store sheet Products and lumber on flat, solid, supports and keep clear of ground. Slope to shed moisture.

.9 Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

.10 Remove and replace damaged Products.

1.7 TRANSPORTATION COSTS OF PRODUCTS

.1 Pay the costs of transportation of products required in the performance of Work.

1.8 MANUFACTURER'S INSTRUCTIONS

.1 Unless otherwise indicated in Specifications, install or erect Products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with Products. Obtain written instructions directly from manufacturers.

.2 Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

.3 Verify that field measurements are as indicated on Shop Drawings or as instructed by the manufacturer.

.4 Notify Contract Administrator in writing, of conflicts between Specifications and manufacturer's instructions, so Contract Administrator may establish course of action.

.5 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

.6 Submit field Drawings to indicate relative position of various services and equipment when required by Contract Administrator.

.7 Improper installation or erection of Products, due to failure in complying with these requirements, authorizes Contract Administrator to require removal and re-installation at no increase in Contract Price or Contract Time.

1.9 QUALITY OF WORK

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Contract Administrator if required Work is such as to make it impractical to produce required results.

.2 Perform Work by persons qualified to produce required and specified quality.

.3 Do not employ anyone unskilled in their required duties. The City reserves right to require dismissal from site, workers deemed incompetent or careless.

.4 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Contract Administrator and The City, whose decision is final.

.5 Monitor quality control over Suppliers, manufacturers, Products, services, site conditions, and workmanship to produce Work of the specified quality.

.6 Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.10 COORDINATION

.1 Contractor is responsible for coordination of Work of various Subcontractors.

.2 Ensure full cooperation of all workers in laying out Work. Maintain efficient and continuous supervision.

.3 Ensure that the Work of various Subcontractors does not conflict or create interference, thus assuring satisfactory performance of Work.

.4 Be responsible for coordination and placement of openings, sleeves and accessories.

.5 All items required to be built in, including anchors, ties, dovetail slots, nailing strips, blocking, sleeves, etc., are to be supplied as and when required, together with templates, measurements and shop drawings.

.6 Ensure all workers examine the drawings and specifications covering the Work of others, which may affect the performance of their own Work. Examine the Work of others and report to the Contract Administrator, in writing, any defects or deficiencies, which may affect the Work. In the absence of any report, the Contractor shall be held to have waived all claims for damage to or defects in such Work.

.7 Ensure that components requiring foundations or openings required for the installation of this Work, is coordinated. Furnish the necessary information to the Sections concerned in ample time to permit allowance for such items. Failure to comply with this requirement does not relieve the party at fault of the cost of cutting or drilling at a later date and subsequent patching.

1.11 CONCEALMENT

.1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

.2 Before installation, inform Contract Administrator if there is interference. Install as directed by Contract Administrator.

.3 Ensure Contract Administrator inspections have been completed and Work is approved prior to concealing the Work.

.4 Contract Administrator reserves the right to direct the Contractor to reveal concealed Work that was not inspected at the sole cost of the Contractor for inspection. Contractor will bear the cost for making good.

.5 Refer to Section 01 73 00 – Execution.

1.12 LOCATION OF EQUIPMENT AND FIXTURES

.1 Consider location of equipment, fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Inform Contract Administrator of conflicting installation. Install as directed.

.3 Refer to Section 01 73 00 – Execution.

1.13 FASTENINGS

.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.

.2 Prevent electrolytic action between dissimilar metals and materials.

.3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior Work, unless stainless steel or other material is specifically requested in affected Specification Section.

.4 Refer to Section 01 73 00 – Execution.

1.14 FASTENINGS - EQUIPMENT

.1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.2 Use heavy hexagon heads, semi-finished unless otherwise specified.

.3 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

.4 Refer to appropriate Specification and Drawings for further detail. Reference manufacturer's Specifications.

.5 Refer to Section 01 73 00 – Execution.

1.15 EXISTING UTILITIES

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to pedestrians, vehicular traffic, Work, and/or building occupants.

.2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

.3 Refer to Section 01 73 29 – Cutting and Patching.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Except where otherwise specified in technical specifications or otherwise indicated on Drawings, comply with requirements of this section.

1.2 MANUFACTURER'S INSTRUCTIONS

.1 Install, erect, or apply Products in strict accordance with manufacturer's instructions.

.2 Notify Contract Administrator, in writing, of conflicts between Contract Documents and manufacturer's instructions where, in Contractor's opinion, conformance with Contract Documents instead of the manufacturer's instructions may be detrimental to the Work or may jeopardize the manufacturer's warranty.

.3 Do not rely on labels or enclosures provided with Products. Obtain written instructions directly from manufacturers.

.4 Provide manufacturer's representatives with access to the Work at all times. Render assistance and facilities for such access so that manufacturer's representatives may properly perform their responsibilities.

.5 Improper installation or erection of products due to failure in complying with these requirements authorizes the Contract Administrator to require any removal and re-installation that may be considered necessary, at no increase in the Contract Price or Contract Time.

1.3 CONCEALMENT

.1 Conceal pipes, ducts, and wiring in floors, walls and ceilings in finished areas:

.1 after review by Contract Administrator and authority having jurisdiction, and

.2 where locations differ from those shown on Drawings, after recording actual locations on as-built drawings.

.2 Provide incidental furring or other enclosures as required.

.3 Notify Contract Administrator in writing of interferences before installation.

1.4 FASTENINGS GENERAL

.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials.

.2 Prevent electrolytic action and corrosion between dissimilar metals and materials by using suitable non-metallic strips, washers, sleeves, or other permanent separators to avoid direct contact.

.3 Use non-corrosive fasteners and anchors for securing exterior work [and in spaces where high humidity levels are anticipated].

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage.

.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

.6 Do not use fastenings or fastening methods that may cause spalling or cracking of material to which anchorage is made.

1.5 FASTENINGS EQUIPMENT

.1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.2 Bolts shall not project more than one diameter beyond nuts. Cut off exposed bolts in public areas flush with the nut.

1.6 FIRE RATED ASSEMBLIES

.1 When penetrating fire rated walls, ceiling, or floor assemblies, completely seal voids with fire-stopping materials, smoke seals, or both, in full thickness of the construction element as required to maintain the integrity of the fire rated assembly.

1.7 BUILDING ENVELOPE ASSEMBLIES

.1 Ensure the continuity of the building envelope as indicated on the drawings, including insulation of the proper RSI (R) value, air/vapour barrier as specified, and backing.

1.8 LOCATION OF FIXTURES, OUTLETS AND DEVICES

.1 Consider location of fixtures, outlets, and devices indicated on Drawings as approximate.

.2 Locate equipment, fixtures, outlets, and devices to provide minimum interference, maximum usable space, and as required to meet safety, access, maintenance, acoustic, and regulatory, including barrier free, requirements.

.3 Promptly notify Contract Administrator in writing of conflicting installation requirements for fixtures, outlets, and devices. If requested, indicate proposed locations and obtain approval for actual locations.

.4 Submit field drawings to indicate relative position of various services and equipment when required by Contract Administrator.

1.9 PROTECTION OF COMPLETED WORK AND WORK IN PROGRESS

.1 Adequately protect parts of the Work completed and in progress from any kind of damage.

.2 Promptly remove, replace, clean, or repair, as directed by Contract Administrator, work damaged as a result of inadequate protection.

.3 Do not load or permit to be loaded any part of the Work with a weight or force that will endanger the safety or integrity of the Work.

.4 Do not cut, drill or otherwise sleeve any load bearing structural member, unless indicated specifically on drawings or in specifications, without written approval of the Contract Administrator.

1.10 REMEDIAL WORK

.1 Notify Contract Administrator of, and perform remedial work required to, repair or replace defective or unacceptable work. Ensure that properly qualified workers perform remedial work. Coordinate adjacent affected work as required. Perform in a manner to neither damage nor put at risk any portion of the Work.

1.11 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit written request in advance of cutting or alteration which affects:

- .1 Structural integrity of any element of Project.
- .2 Integrity of weather-exposed or moisture-resistant elements.
- .3 Efficiency, maintenance, or safety of any operational element.
- .4 Visual qualities of sight-exposed elements.
- .5 Work of The City or separate Contractor.

.2 Include in request:

- .1 Identification of Project.
- .2 Location and description of affected Work.
- .3 Statement on necessity for cutting or alteration.
- .4 Description of proposed Work, and Products to be used.
- .5 Alternatives to cutting and patching.
- .6 Effect on Work of The City or separate Contractor.
- .7 Written permission of affected separate Contractor.
- .8 Date and time Work will be executed.

1.12 PREPARATION

.1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.2 After uncovering, inspect conditions affecting performance of Work.

.3 Beginning of cutting or patching means acceptance of existing conditions.

.4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of Project from damage.

.5 Provide protection from elements for areas which may be exposed by uncovering Work; maintain excavations free of water.

1.13 EXECUTION

.1 Execute cutting, fitting, and patching including excavation and fill, to complete Work.

.2 Fit several parts together, to integrate with other Work.

.3 Uncover Work to install ill-timed Work.

.4 Remove and replace defective and non-conforming Work.

.5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.

.6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

.7 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

.8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry Work without prior approval.

.9 Restore Work with new Products in accordance with requirements of Contract Documents.

.10 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with fire stopping material, full thickness of the construction element.

.12 Refinish surfaces to match adjacent finishes: For continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.

.13 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

.14 Where pipes, ducts and wiring cannot be concealed in floors, walls and ceilings install furring/bulkheads finished with drywall. Coordinate locations and dimensions in consultation with Contract Administrator prior to commencement.

.15 Meet or exceed Product manufacturer’s installation requirements.

1.14 SUB-DIVISION OF WORK

.1 The Specifications have generally been divided into sections for the purpose of ready reference, but a section may consist of the Work of more than one trade Subcontractor or Supplier.

.1 The responsibility for determining which Subcontractor or Supplier provides labour, material, equipment and services to complete the Work rests solely with the Contractor.

.2 No extras will be allowed on grounds of differences of interpretation of Contract Documents as to which Subcontractor or Supplier is to provide labour, material, equipment or services, including the taking of field measurements.

1.15 CONTRACTOR'S RESPONSIBILITIES

.1 Ensure the Work erected is in compliance with Contract Documents and be responsible for delays or costs resulting from failure to inspect or co-ordinate, and for any replacement or corrective Work required.

.2 Provide advance notification to, and coordination with/between, Other Contractors, Subcontractors, and those otherwise performing Work of other sections.

1.16 COMMISSIONING

.1 Ensure testing, adjusting, balancing, and certification of mechanical and electrical installations and other automated systems or equipment are executed in compliance with Contract Documents.

END OF SECTION

Part 1 GENERAL

1.1 REQUEST FOR CUTTING, PATCHING AND REMEDIAL WORK

.1 Submit written request in advance of cutting, coring, or alteration which affects or is likely to affect:

- .1 Structural integrity of any element of the Work.
- .2 Integrity of weather-exposed or moisture-resistant elements.
- .3 Efficiency, maintenance, or safety of any operational element.
- .4 Visual qualities of sight-exposed elements.
- .5 Work of The City or other contractors.
- .6 Warranty of Products affected.
- .7 Likely to disturb environmental hazards, including, but not limited to, asbestos, lead, mould, PCBs or vermiculite.

.2 Include in request:

- .1 Identification of Project.
- .2 Location and description of affected work, including drawings or sketches as required.
- .3 Statement on necessity for cutting or alteration.
- .4 Description of proposed work, and Products to be used.
- .5 Alternatives to cutting and patching.
- .6 Effect on work of The City or other contractors.
- .7 Written permission of affected other contractors.
- .8 Date and time work will be executed.

1.2 PRODUCTS

.1 Unless otherwise specified, when replacing existing or previously installed Products in the course of cutting and patching work, use replacement Products of the same character and quality as those being replaced.

.2 If an existing or previously installed Product must be replaced with a different Product, submit request for substitution.

1.3 PREPARATION

.1 Provide supports to ensure structural integrity of surroundings; provide devices and methods to protect other portions of the Work from damage.

.2 Provide protection from elements for areas that may be exposed by uncovering work.

1.4 EXISTING UTILITIES

.1 When breaking into or connecting to existing services' utilities, execute the Work at times directed by local governing authorities, with a minimum of disturbance to the Work, pedestrian and vehicular traffic, and ongoing City operations.

.2 Maintain excavations free of water.

.3 Keep duration of interruptions to a minimum.

.4 Protect and maintain existing active services. Record location of services, including depth, on as-built Drawings.

.5 Construct or erect barriers in accordance with Section 01 56 00 – Temporary Barriers and Enclosures as required to protect pedestrian and vehicular traffic.

.6 Refer to Section 01 61 00 – Common Product Requirements.

1.5 CUTTING, PATCHING, AND REMEDIAL WORK

.1 Coordinate and perform the Work to ensure that cutting and patching work is kept to a minimum.

.2 Perform cutting, fitting, patching, and remedial work [including excavation and fill,] to make the affected parts of the Work come together properly and complete the Work.

.3 Provide openings in non-structural elements of the Work for penetrations of mechanical and electrical work.

.4 Perform cutting by methods to avoid damage to other work. Cutting to be "neat" sizes. Patch all edges so fixture frames hide cut edges.

.5 Provide proper surfaces to receive patching, remedial work, and finishing.

.6 Perform cutting, patching, and remedial work using competent and qualified specialists familiar with the Products affected, in a manner that neither damages nor endangers the Work.

.7 Do not use pneumatic or impact tools without Contract Administrator’s prior approval.

.8 Ensure that cutting, patching, and remedial work does not jeopardize manufacturers’ warranties.

.9 Refinish surfaces to match adjacent finishes. For continuous surfaces refinish to nearest intersection. For an assembly, refinish entire unit.

.10 Fit work to pipes, sleeves, ducts, conduit, and other penetrations through surfaces with suitable allowance for deflection, expansion, contraction, acoustic isolation, and firestopping.

.11 Maintain fire ratings of fire rated assemblies where cutting, patching, or remedial work is performed. Completely seal voids or penetrations of assembly with firestopping material to full depth or with suitably rated devices.

END OF SECTION

Part 1 GENERAL

1.1 REGULATORY REQUIREMENTS

.1 Comply with applicable regulatory requirements when disposing of waste materials.

.2 Obtain permits from authorities having jurisdiction and pay disposal fees where required for disposal of waste materials and recyclables.

1.2 GENERAL CLEANING REQUIREMENTS

.1 Provide adequate ventilation during use of volatile or noxious substances. Do not rely on building ventilation systems for this purpose.

.2 Prevent cross-contamination during the cleaning process.

.3 Notify the Contract Administrator of the need for cleaning caused by The City or other contractors.

.4 Conduct cleaning up and disposal of construction waste to comply with local ordinances and anti-pollution laws.

.5 Prevent accumulation of wastes which create hazardous conditions.

.6 Should the Contractor fail to perform ongoing or final cleanup when required by the City, the City may have the cleanup performed by whatever means may be expedient and all associated costs will be charged to the Contractor. The City may set-off such costs against any amount owing to the Contractor.

Part 2 MATERIALS

2.1 CLEANING MATERIALS

.1 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

Part 3 EXECUTION

3.1 PROGRESSIVE CLEANING AND WASTE MANAGEMENT

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris.

.2 Provide appropriate, clearly marked, containers for collection of waste materials and recyclables.

.3 Remove waste materials and recyclables from work areas, separate, and deposit in designated containers at end of each Working Day. Collect packaging materials for recycling or reuse.

.4 Remove all waste materials and debris from the site at regular scheduled times or dispose of as otherwise directed by the Contract Administrator.

.5 Clear snow and ice from public sidewalks and parking areas as required to comply with applicable municipal regulatory requirements, and from access to building. Bank/pile snow in designated areas only or remove from site as directed by the City or Contract Administrator.

.6 Regularly maintain existing lawn on site to the approval of the City.

.7 Make arrangements with and obtain permits from authorities having jurisdiction for off-site disposal of waste and debris.

.8 Clean interior areas prior to start of finish work, and maintain areas free of dust and other contaminants during finishing operations.

.9 Store volatile waste in covered metal containers, and remove from premises at end of each working day.

.10 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

.11 Remove all construction waste materials and debris from the building and site, and clean soiled areas immediately. Maintain adjacent corridors and the site free of construction waste and soiling.

3.2 FINAL CLEANING

.1 Before final cleaning, arrange a meeting at Place of the Work to determine the acceptable standard of cleaning. Ensure that the City, Contract Administrator, Contractor and cleaning company are in attendance.

.2 Remove from Place of the Work surplus Products, waste materials, recyclables, Temporary Work, tools and Construction Equipment not required to perform any remaining work.

.3 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.

.4 Provide professional cleaning by a qualified, established cleaning company.

.5 Lock or otherwise restrict access to each room or area after completing final cleaning in that area.

.6 Inspect finishes, fitments, and equipment and ensure specified workmanship and operation.

.7 Re-clean as necessary areas that have been accessed by Contractor's workers prior to The City occupancy.

.8 Remove stains, spots, marks, and dirt from finished surfaces, electrical and mechanical fixtures, furniture fitments, walls, floors and ceilings.

.9 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, aluminum and all other finished surfaces, including mechanical and electrical fixtures. Replace broken, scratched or otherwise damaged glass.

.10 Remove dust and stains from lighting reflectors, lenses, lamps, bulbs, and other lighting surfaces.

.11 Vacuum clean and dust all new and renovated exposed wall, floor, and ceiling surfaces, behind grilles, louvres and screens, and above suspended ceiling tiles.

.12 Clean mechanical, electrical, and other equipment. Replace filters for mechanical equipment if equipment is used during construction.

.13 Remove waste material and debris from crawlspaces and other accessible concealed spaces.

.14 Remove stains, spots, marks, and dirt from exterior facades.

.15 Clean exterior and interior window glass and frames.

.16 Clean and sweep roofs, clear roof drains.

.17 Sweep clean, power wash, or remove snow and ice from exterior sidewalks, steps and platforms, driveways, roads, parking lots, and other paved surfaces.

.18 Use leaf blowers to clean landscaped surfaces. Rake clean other surfaces of grounds. Mow lawn.

.19 Remove all dirt and other disfigurations from new and altered exterior surfaces.

3.3 WASTE MANAGEMENT AND DISPOSAL

.1 Dispose of waste materials and recyclables at appropriate municipal landfills and recycling facilities in accordance with applicable regulatory requirements.

.2 Do not burn or bury waste materials at Place of the Work.

.3 Do not dispose of volatile and other liquid waste such as mineral spirits, oil, paints and other coating materials, paint thinners, cleaners, and similar materials together with dry waste materials or on the ground, in waterways, or in storm or sanitary sewers. Collect such waste materials in appropriate covered containers, promptly remove from Place of the Work, and dispose of at recycling facilities or as otherwise permitted by applicable regulatory requirements.

.4 Cover or wet down dry waste materials to prevent blowing dust and debris.

3.4 CLEANING OF STREETS

.1 Conform to local ordinances and by-laws relating to littering of streets.

.2 Take precautions to prevent depositing mud or debris on public or private roadways adjacent to the Work. Clean up immediately or the Contract Administrator will direct necessary clean up with all costs charged to the Contractor by deducting costs from the next progress payment.

3.5 REMOVAL OF TEMPORARY FACILITIES

.1 On completion of project, remove all temporary offices and furniture, hoardings, fencing, tree and plant protection, and all other items used to aid in the performance of the Work. Return site to original condition as at start of the Work.

END OF SECTION

Part 1 GENERAL

1.1 GENERAL

.1 Notify the City one (1) month prior to anticipated takeover to make arrangements for insurance and coordinate takeover of utilities.

.2 Refer to Section 01 78 43, Spare Parts and Maintenance Materials, and provide written confirmation signed by the City, that all spare parts and maintenance materials have been provided to the City as prescribed therein.

1.2 SUBSTANITAL COMPLETION OF THE WORK

.1 Contractor's Inspection: Before applying for the Contract Administrator’s review to establish Substantial Completion of the Work:

.1 Ensure that the specified prerequisites to Substantial Completion of the Work are completed.

.1 Follow final cleaning instructions per Section 01 74 00 – Cleaning and Waste Management.

.2 Provide the following operations and maintenance documents: outline the specific O&M documents reasonably necessary for immediate operation and maintenance.

.3 Ensure start-up requirements are completed.

.4 Demonstration and training of The City’s on-site personnel is scheduled.

.2 Conduct an inspection of the Work to identify defective, deficient, or incomplete work.

.3 Prepare a comprehensive and detailed list of items to be completed or corrected.

.4 Provide an anticipated schedule and costs for items to be completed or corrected.

.2 Acceptance of Work Procedures:

.1 Contractor's Inspection: Contractor shall conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.

.1 Notify Contract Administrator in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.

.2 Request Contract Administrator's inspection.

.2 Contract Administrator's Inspection:

.1 Contract Administrator and Contractor to inspect Work and identify defects and deficiencies.

.2 Contractor to correct Work as directed.

.3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:

.1 Work: completed and inspected for compliance with Contract Documents.

.2 Defects: corrected and deficiencies completed.

.3 Equipment and systems: tested, balanced, adjusted and fully operational.

.4 Certificates required by Fire Commissioner, Boiler Inspection Branch and Utility companies: submitted.

.5 Operation of systems: demonstrated to The City's personnel.

.6 Commissioning of mechanical systems: completed in accordance with Contract Documents.

.7 Work: complete and ready for final inspection.

.4 Final Inspection:

.1 When completion tasks are done, request final inspection of Work by Contract Administrator, The City and Contractor.

.2 When Work incomplete according to Contract Administrator, complete outstanding items and request re-inspection.

.3 Declaration of Substantial Performance: when Contract Administrator considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.

.5 Outstanding deficiencies on the date of Substantial Completion shall be recorded for warranty purposes.

1.3 PREREQUISITES TO FINAL PAYMENT

.1 After Substantial Completion and before submitting an application for final payment in accordance with the General Conditions of Contract:

.1 Correct or complete all remaining defective, deficient, and incomplete work.

.2 Remove from the Place of the Work all remaining surplus Products, Construction Equipment, and Temporary Work.

.3 Perform final cleaning and waste removal necessitated by Contractor’s work performed after Substantial Completion, as specified in Section 01 74 00 – Cleaning and Waste Management.

.4 Turn over all keys for the building, systems, and equipment. Request and sign for any key(s) retained/used for completion of the Work, as acceptable to the City.

.5 Record all utility readings with the City at the date of Substantial Completion.

.6 Coordinate completion of any outstanding deficiencies with the City to avoid disruption to the City's use.

1.4 WARRANTY PERIODS

.1 Refer to General Conditions GC 12.3, for warranty periods. Note that warranty does not start on deficiencies listed at the date of Ready-for-Takeover until their completion or repair.

.2 During the month prior to the end of the project warranty period, the City, the Contract Administrator and the Contractor will conduct an inspection of the project. Promptly remedy any defects due to faulty materials or workmanship.

END OF SECTION

Part 1 GENERAL

1.1 OPERATION AND MAINTENANCE MANUAL

.1 Prepare a comprehensive operation and maintenance manual, in the languages of the Contract, using personnel qualified and experienced for this task.

.2 Submit an initial draft of the operation and maintenance manual for Contract Administrator's review. If required by Contract Administrator's review comments, revise manual contents and resubmit for Contract Administrator's review. If required, repeat this process until Contract Administrator accepts the draft manual in writing.

.3 Submit final version to The City in hard copy and electronic format. Provide three (3) hard copies.

1.2 OPERATION AND MAINTENANCE MANUAL FORMAT

.1 Organize data in the form of an instructional manual.

.2 Binders: black vinyl, hard covered, three D-rings, loose leaf, 216 x 279mm, with spine and face pockets.

.3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.

.4 Cover: Identify each binder with typed or printed title "Operation and Maintenance Manual", name of Project or facility, and subject matter of contents.

.5 Arrange content by systems, under Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate Product or system, with typed description of Product and major component parts of equipment.

.7 Text: Manufacturer's printed data, or typewritten data.

.8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

.9 Include electronic copy of Shop Drawings in manual as 1:1 scaled CAD files in .pdf format on electronic media acceptable to The City.

.10 Provide electronic copy of manual in PDF format.

1.3 OPERATION AND MAINTENANCE MANUAL – GENERAL CONTENT

.1 Table of contents for each volume.

.2 Introductory information including:

.1 Date of manual submission.

.2 Complete contact information for Contract Administrator, subContract Administrators, other Contract Administrators, and Contractor, with names of responsible parties.

.3 Schedule of Products and systems indexed to content of volume.

.3 For each Product or system, include complete contact information for Subcontractors, Suppliers and manufacturers, including local sources for supplies and replacement parts.

.4 Product Data: mark each sheet to clearly identify specific products, options, and component parts, and data applicable to installation. Delete or strike out inapplicable information. Supplement with additional information as required.

.5 Reviewed Shop Drawings.

.6 Permits, certificates, letters of assurance and other relevant documents issued by or required by authorities having jurisdiction.

.7 Warranties and Performance Bond.

.8 Operating and maintenance procedures, incorporating manufacturer's operating and maintenance instructions, in a logical sequence.

.9 Training materials as specified in Section 01 79 00 – Demonstration and Training.

.10 Addenda.

1.4 OPERATION AND MAINTENANCE MANUAL – EQUIPMENT AND SYSTEMS CONTENT

.1 Each Item of Equipment and Each System: include description of unit or system and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel Board Circuit Directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.6 Provide servicing and lubrication schedule, and list of lubricants required.

.7 Include manufacturer's printed operation and maintenance instructions.

.8 Include sequence of operation by controls manufacturer.

.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.

.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.14 Include testing and balancing reports.

.15 Include additional content as specified in technical Specifications sections. Refer to Mechanical specifications, and Electrical Section 26 00 00.

1.5 OPERATION AND MAINTENANCE MANUAL – PRODUCTS AND FINISHES CONTENT

.1 Include Product data, with catalogue number, options selected, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured Products.

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Include an outline of requirements for routine and special inspections and for regular maintenance to ensure that on-going performance of the building envelope will meet the initial building envelope criteria.

.4 Include copy of finish hardware including addenda or changes during construction.

.5 Included copy of full colour schedule including addenda or changes during construction.

.6 Include additional content as specified in technical Specifications sections.

1.6 OPERATION AND MAINTENANCE MANUAL – WARRANTIES CONTENT

.1 Separate each warranty with index tab sheets keyed to Table of Contents listing.

.2 List each warrantor with complete contact information.

.3 Verify that documents are in proper form and contain full information. Ensure that warranties are for the correct duration and are in The City's name.

1.7 CONTRACTOR'S AS-BUILT DRAWINGS

.1 Submit final as-built drawings in the form specified in Section 01 32 00 – Construction Progress Documentation to Contract Administrator.

1.8 RECORD DRAWINGS

.1 Pay Contract Administrator to have information transferred from the 'As-Built' drawings to a set of electronic (AutoCad) Record Drawings. Submit marked-up set of 'As-Built' drawings to the Contract Administrator showing information to be included on record drawings at least 15 working days prior to Substantial Performance of the Work. The Contract Administrator will prepare electronic Record Drawings except, mechanical and electrical, based on the marked-up 'As-Built' drawings for a fee of $200 per drawing ($100 per 11" x 17" drawing), with a minimum charge of $1,000. Mechanical and electrical contractors shall refer to the mechanical and electrical specifications for requirements for preparation of mechanical and electrical record drawings.

.2 Contract Administrator will provide the City with a hard copy and digital copy of the Record Drawings.

1.9 SPARE PARTS, MAINTENANCE MATERIALS, AND SPECIAL TOOLS

.1 Supply spare parts, maintenance materials, and special tools in quantities specified in technical specifications sections.

.2 Ensure spare parts and maintenance materials are new, not damaged nor defective, and of same quality, manufacturer, and batch or production run as installed Products.

.3 Provide tags for special tools identifying their function and associated Product.

.4 Deliver to and store items at location directed by The City at Place of the Work. Store in original packaging with manufacturer's labels intact and in a manner to prevent damage or deterioration.

.5 Catalogue all items and submit to Contract Administrator an inventory listing organized by Specifications section. Include Contract Administrator reviewed inventory listing in operation and maintenance manual.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Demonstrate and provide training to The City's personnel on operation and maintenance of equipment and systems prior to scheduled date of Substantial Performance of the Work.

.2 The City will provide list of personnel to receive training and will coordinate their attendance at agreed upon times.

.3 Coordinate and schedule demonstration and training provided by Subcontractors and Suppliers.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit proposed dates, times, durations, and locations for demonstration and training of each item of equipment and each system for which demonstration and training is required. Allow sufficient time for training and demonstration for each item of equipment or system, or time as may be specified in technical specifications.

.2 Contract Administrator and The City will review submittal and advise Contractor of any necessary revisions.

.3 Submit report(s) within five (5) Working Days after completion of demonstration and training:

.1 identifying time and date of each demonstration and training session,

.2 summarizing the demonstration and training performed, and

.3 including a list of attendees.

.4 If requested by the City, submit video record of demonstration and training together with report.

.1 Video record training instructions for operation, range of features, control, adjustment, maintenance and servicing of fixtures and equipment.

.2 Capture within the recording, video and audio, the instructor's training presentations for each item.

.3 Recording camera(s) must be attended by dedicated operator during recording sessions to assure subject material is visible and readable when viewed as training material. Operator is to utilize a tripod to steady the video recording device where possible.

1.3 PREREQUISITES TO DEMONSTRATION AND TRAINING

.1 Testing, adjusting, and balancing has been performed in accordance with Contract Documents.

.2 Equipment and systems are fully operational.

.3 Copy of completed operation and maintenance manual is available for use in demonstration and training.

.4 Conditions for demonstration and training comply with requirements specified in technical Specifications.

1.4 DEMONSTRATION AND TRAINING

.1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment and system.

.2 Review operation and maintenance manual in detail to explain all aspects of operation and maintenance.

.3 Prepare and insert additional information in operation and maintenance manual if required.

1.5 INSTRUCTION TO THE CITY'S PERSONNEL

.1 In addition to start-up supervision and instruction to The City's personnel required oftindividual equipment manufacturers and systems noted, instruct The City's personnel in operation and maintenance of all equipment and systems.

.2 Review instructions with The City's representative to ensure a thorough understanding of equipment and its operation.

.3 Submit to the Contract Administrator a copy of written documentation that instruction has been provided, signed by the City's representative.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA)

.1 CSA S350 – Code of Practice for Safety in Demolition of Structures

.2 Carry out demolition Work in accordance with standard safety practice and applicable laws and codes.

1.2 EXAMINATION

.1 Carefully examine drawings and site conditions to determine the full extent of demolition and renovation Work to be performed and materials and conditions encountered.

1.3 EXISTING CONDITIONS

.1 Take over elements to be demolished generally based on their condition during the Bid Period.

.2 Prevent damage to existing concealed, hidden, poured-in, or buried utilities, service lines, structural rebar, conduits, cables or mechanical equipment in or under the floor slab. Carry out all investigation necessary to confirm location of such utilities, service lines, structural rebar, conduits, cables or mechanical equipment, which may or may not include scanning the floor. Repair to existing utilities, service lines, structural rebar, conduits, cables or mechanical equipment damaged during the course of the work is the responsibility of the Contractor and at the Contractor's expense.

.3 Arrange and pay for disconnecting, removing and capping utility services within areas of demolition as required. Notify affected utility company prior to commencing.

.4 Place markers to indicate location of disconnected services. Identify service lines and capping locations on Record drawings.

.5 Demolition of asbestos containing materials (ACM) and mould contaminated components (MCC) can be hazardous to health. Should material resembling ACM or MCC be encountered in the course of demolition Work, stop Work, and notify Contract Administrator immediately. Do not proceed until written instructions have been received from the Contract Administrator.

.1 Refer to Hazardous Materials Abatement specifications in Division 2.

1.4 DEMOLITION INFORMATION

.1 Where required by authorities having jurisdiction, submit for approval, drawings, diagrams, or details showing sequence of disassembly Work, supporting structures and underpinning.

.2 Provide information in form set out by authorities having jurisdiction, including stamp of qualified professional engineer registered in the Province of Manitoba.

1.5 PROTECTION

.1 Do not interfere with the use of adjacent building areas. Maintain free and safe passage to and from.

.2 Prevent movement or settlement of structures. Provide and place bracing or shoring and be responsible for safety and structure. Be liable for any such movement or settlement and any damage or injury caused.

.3 If safety of structure appears to be endangered, cease operations, and notify the Contract Administrator immediately. Take all precautions to properly support structure. Do not resume operations until acceptable to the Contract Administrator.

.4 Erect access resistant and weatherproof enclosures as required to close-off exterior openings. Maintain exit requirements.

.5 Erect and maintain dustproof partitions as required to prevent spread of dust, fumes and smoke to other parts of the building. Provide plastic tarps to protect furniture, fixed millwork, and bookcases, from dust and debris. On completion, remove partitions and tarps, and make good damaged surfaces to match adjacent surfaces.

.6 Prevent dust from entering the air handling system. Inspect air filters and clean or replace during period system is in use, and prior to turnover.

.7 Prevent debris from blocking surface drainage inlets and systems, or mechanical and electrical systems, which must remain in operation.

.8 During the removal of the existing building elements, provide proper protection from falling objects.

.9 Post warning signs, which are clearly visible.

.10 Carry out demolition Work in a manner to cause minimal inconvenience to the adjacent occupied areas.

Part 2 PRODUCTS

Not used.

Part 3 EXECUTION

3.1 DEMOLITION

.1 Perform demolition of existing work necessary to accommodate new and remedial Work indicated on the drawings, and/or described in the specifications. This shall include all necessary demolition Work and all miscellaneous cutting required for the installation or extension of services.

.2 Repair all demolition in excess of that indicated or required, to the approval of the Contract Administrator, at no cost to The City.

.3 Remove existing construction, millwork, fixtures, equipment, services, and obstacles where required for new Work, refinishing, or making good of existing surfaces, and replace same as Work progresses.

.4 At the end of each days Work leave building, site and Work in a safe condition. Protect interiors or parts not to be demolished from exterior elements.

.5 Demolish to minimize dusting. Keep materials wetted, as directed by the Contract Administrator.

3.2 RENOVATION

.1 Carefully remove, store, protect and reinstall in building, using qualified tradesmen, materials and equipment as required.

.2 Patch and make good existing surfaces to provide neat, uniform finish.

.3 Patch and make good existing surfaces to match existing adjacent Work. Leave finished, neat, to Contract Administrator’s approval.

.4 Patch surfaces with materials similar to existing, to maintain fire and acoustic ratings, and structural integrity.

.5 Where existing building components and fixtures are removed, patch and make good, and finish the existing surface (include paint, flooring or ceiling finish as required) to match adjacent surfaces to the Contract Administrator’s approval.

.6 Neatly perform patching Work to blend smoothly with surrounding surfaces.

.7 Infill of masonry openings shall be “toothed-in”.

.8 Where existing finishes or materials are demolished to carry out the work required in the contract, the demolition shall be patched to match existing.

3.3 DISPOSAL

.1 Dispose of demolished materials, except where noted otherwise, in accordance with local authorities have jurisdiction.

.2 Selling or burning materials on site is not permitted.

.3 Remove contaminated or dangerous materials from worksite, and dispose of in safe manner to minimize danger at site and during disposal.

.4 Deliver all refuse materials to a registered landfill site and pay all costs of disposal.

.5 Employ rodent and vermin exterminators as required to comply with health regulation.

.6 Leave site in condition acceptable to the Contract Administrator.

3.4 SALVAGE TO THE CITY

.1 Carefully remove materials and fixtures designated to be removed and not reused, and turn over to The City.

.2 Generally:

.1 Shelving
.2 Pressed metal ceilings
.3 Interior doors
.4 Appliances
.5 Light fixtures, heating units, plumbing fixtures
.6 Motors, pumps, fans

.3 If The City does not want removed materials, then dispose as noted above.

END OF SECTION

PART 1 GENERAL

1.1 General and Related Work

.1 Read this Section in conjunction with all drawings and all other Sections so as to comply with the requirements of Division 1 and the General Conditions of the Contract.

.2 Related work specified elsewhere:

.3

Section 02 82 00.01	Asbestos Abatement – Type 1 (Low Risk) Procedures
Section 02 82 00.02	Asbestos Abatement – Type 2 (Moderate Risk) Procedures
Section 02 82 00.03	Asbestos Abatement – Type 3 (High Risk) Procedures
Section 02 82 00.04	Asbestos Abatement – Type 2 Glove Bag Method
Section 02 83 10	Lead Abatement – Type 1 (Low Risk) Precautions
Section 02 85 12	Silica and Heavy Metals Abatement – Type 3 (High Risk) Precautions

.4 Site Conditions identifies all known hazardous building materials within the Project Area. The information provided is for general reference only. Each Contractor must confirm existing conditions on site prior to tender close.

The specification fulfils the requirements of Part 36 and 37 of Manitoba Workplace Safety and Health Regulation 217/2006.

.5 The Outline of Work identifies the location, condition, and quantities of hazardous building materials to be removed as part of this project.

It is the intent that work prescribed this Section will result in the removal of all hazardous materials as outlined and the decontamination of all surfaces or materials which may have been or become contaminated by hazardous materials either during or prior to work of this Contract.

1.2 Site Conditions

.1 Refer to the report entitled “Hazardous Materials Gap Analysis, City of Winnipeg Archives Building, 380 William Avenue, Winnipeg, Manitoba”, dated November 3, 2023, prepared by Tesseract.

.2 Asbestos

The following materials have been confirmed to contain asbestos:

.1 Vinyl floor tiles at various locations throughout the building.

.2 Transite wall panels in various locations throughout the building.
.3 Parging cement on pipe fittings at various locations throughout the building.
.4 Red duct mastic in the Boiler Room and Developing Film Room.
.5 Black mastic on the jacketing of duct insulation in the East Washroom.
.6 Drywall joint compound present on drywall wall finishes on the Main Floor.

.3 Lead

Paint throughout the building is known to contain lead.

.4 General Building Conditions

Heat and smoke detectors to remain live throughout work.

Sprinklers to remain live throughout work.

Fan unit motors will remain active.

1.3 Outline of Work

.1 Coordinate the following items with the Owner's Project Manager and the Construction Manager, including but not limited to: electrical isolations, GFI connection, water connections, HVAC and exhaust ventilation system isolation, bin placement, schedule, disconnects, etc.

.2 Refer to the Contract Drawings prepared by MCM Architects for the extent of construction work and the Work Areas.

.3 Install Hoarding Walls between Abatement Work Areas and Occupied Areas where required.

.4 Using procedures prescribed in the Sections identified in Related Work, remove, and dispose of the following:

Asbestos-containing vinyl floor tiles at locations scheduled for demolition.

Asbestos-containing transite wall panels at locations scheduled for demolition.

Asbestos-containing pipe insulations at locations scheduled for demolition.

Asbestos-containing red and black duct mastic at locations scheduled for demolition.

Drywall with drywall joint compound containing chrysotile asbestos at locations scheduled for demolition.

Removal of lead-containing finishes to prepare finishes for new paint.

.5 Refer to Specification Sections identified in the Related Work for specified personnel protective measures for the safe handling, removal, or clean-up of hazardous materials in each phase or work area.

.6 Visit the site prior to tender close to confirm the location and extent of any hazardous building materials or materials contaminated by hazardous materials.

.7 Protect surfaces, building fabrics and items remaining within the Abatement Work Area.

.8 Without disturbing hazardous materials, perform removals where required, prior to abatement work.

Maximize waste diversion by use of resale of building materials, or recycling.

.9 Isolate the Abatement Work Area from adjoining Occupied and Non-Occupied Areas whether present at an interior or exterior location.

.10 Maintain emergency and fire exits from Abatement Work Area, or establish alternative exits satisfactory to Provincial Fire Marshall and local authorities having jurisdiction. Maintain extra routes from occupied areas. Place emergency exit signs at locations to clearly mark exit route. Seal emergency exit doors so as not to impede use of door during emergency evacuation.

.11 Perform selective demolition of mechanical and electrical equipment, building components, materials and items scheduled for demolition at locations required to facilitate asbestos removal. Refer to all Contract Documents for responsibility of demolition work and disposal.

.12 Remove and dispose of as appropriate waste, building components, materials and items contaminated by hazardous materials that cannot be effectively cleaned.

.13 Encapsulate remaining hazardous materials at locations where removal is deemed impractical by the Abatement Consultant.

.14 Encapsulation will not be permitted where removal of building materials or structures scheduled for demolition will facilitate access to the asbestos materials in question.

.15 Final clean work area to remove visible signs of asbestos and other hazardous materials, other debris or settled dust.

.16 Apply lock-down agent to exposed surfaces throughout the work area and to surfaces from which any hazardous materials have been removed.

Do not apply lock-down to materials which would be damaged by its application.

.17 Unless otherwise specified, the handling, removal, clean-up or repair of hazardous materials or surfaces contaminated with hazardous materials is to be performed following wet removal techniques.

1.4 Schedule

.1 Provide necessary manpower, supervision, equipment, and materials to maintain and complete the project on schedule.

.2 Work Hours:

Coordinate all work, scheduling and phasing with the Owner.

NOTE: Duration for which HVAC systems may remain shutdown to accommodate quiet hours work will vary in accordance with outside weather conditions and internal demand. Duration of quiet hours work will have to be scheduled accordingly and in consultation with the Abatement Consultant.

.3 Provide 48 hours written notice to the Abatement Consultant of any request to work outside normal working hours. Obtain written approval before proceeding.

1.5 Definitions

.1 Abatement Consultant: Owner's Representative providing inspection and air monitoring.

.2 Abatement Contractor: Contractor or sub-contractor performing work of this section.

.3 Abatement Work Area: Area where work takes place which will, or may, disturb hazardous materials.

.4 Amended Water: Water with wetting agent added for the purpose of reducing surface tension to allow thorough wetting of materials.

.5 Asbestos: Any of the fibrous silicates defined in Regulation 217/2006 including: actinolite, amosite, anthophyllite, chrysotile, crocidolite and tremolite.

.6 Asbestos-Containing Material (ACM): Material identified under Site Conditions including any debris, overspray, fallen material and settled dust.

.7 Authorized Visitors: Building Owner, Abatement Consultant, or designated representative, and persons representing regulatory agencies.

.8 Competent Worker: A worker who is qualified because of knowledge, training, and experience to perform the work, is familiar with applicable regulations and guidelines, and has knowledge of the potential or actual danger to health and safety in the work.

.9 Contaminated Waste: Material identified under Site Conditions, including fallen material, settled dust, other debris and materials or equipment deemed to be contaminated by the Abatement Consultant.

.10 Curtained Doorway: Doorway consisting of two (2) overlapping flaps of rip-proof polyethylene arranged to permit ingress and egress from one room to another while permitting minimal air movement between rooms.

.11 DOP Test: A testing method used to determine the integrity of the Negative Pressure unit or vacuum using a Dispersed Oil Particulate (DOP) or Poly Alpha Olefin (PAO) HEPA filter leak test. This test is to be conducted on site where units are to be installed. Refer to the Environmental Abatement Council of Ontario (EACO) DOP/PAO Testing Guideline 2013 or ANSI/ASME N510-2007.

.12 Fitting: Individual segments or pieces of a mechanical service line which may include but is not limited to the hangers, tees, elbows, joints, valves, unions, etc.

.13 Friable Material: Material that when dry can be crumbled, pulverized, or powdered by hand pressure and includes such material that is crumbled, pulverized, or powdered.

.14 HEPA Filter: High Efficiency Particulate Aerosol filter that is at least 99.97 percent efficient in collecting a 0.3 micrometre aerosol.

.15 Lead-Containing: Paints containing lead at a concentration of 0.009% (90 ppm) or greater.

.16 Lead Waste: Waste generated from removal of lead-containing materials, or the substrate and paint finish where left intact.

.17 Milestone Inspection: Inspection of the Abatement Work Area at a defined point in the abatement operation.

.18 Negative Pressure: A reduced pressure within the Abatement Work Area (> 0.02 inches of water column) established by extracting air directly from Abatement Work Area and discharging it to exterior of building.

.19 Non-Friable Material: Material that when dry cannot be crumbled, pulverized, or powdered by hand pressure.

.20 Occupied Area: Any area of the building or adjoining space outside the Abatement Work Area.

.21 Personnel: All Contractor's employees, sub-contractor's employees, supervisors.

.22 PCM: Phase Contrast Microscopy.

.23 Remove: Remove means remove and dispose of (as applicable type of waste) unless followed by other instruction (e.g., remove and turn over to Owner).

.24 Toxicity Characteristic Leachate Procedure (TCLP): Laboratory analysis to determine leachable parameters in lead waste.

1.6 Regulations and Guidelines

.1 Comply with Federal, Provincial, and local requirements, provided that in any case of conflict among those requirements or with these Specifications, the more stringent requirements shall apply. Work shall be performed under regulations in effect at the time work is performed.

.2 Where regulations are not present, follow accepted industry standards and applicable Guideline documents.

.3 Regulations and Guidelines include but are not limited to the following:

Workplace Safety and Health Act W210.

Workplace Safety and Health Regulation M.R. 217/2006

Safe Work Manitoba Guide for Asbestos Management

The Dangerous Goods Handling and Transportation Act C.C.S.M c. D12.

Hazardous Waste Regulation, M.R. 195/2015.

Dangerous Goods Handling and Transportation Regulation, M.R. 55/2003.

Transportation of Dangerous Goods Regulation (SOR 219/2019-101).

1.7 Quality Assurance

.1 Removal and handling of hazardous materials is to be performed by persons trained in the methods, procedures, and industry practices for Abatement.

.2 Ensure work proceeds to schedule, meeting all requirements of this Specification.

.3 Complete work so that at no time airborne dust, visible debris, or water runoff contaminate areas outside the Abatement Work Area.

.4 Any contamination of surrounding area (indicated by visual inspection or air monitoring) shall necessitate the clean-up of affected area, and in the same manner applicable to an Abatement Work Area at no cost to the Owner.

.5 All work of this Section involving electrical, mechanical, carpentry, glazing, etc., shall be performed by licensed persons experienced and qualified for the work required.

1.8 Supervision

.1 Provide on site, an Overall Superintendent(s), who has authority to oversee all aspects of the work, including but not limited to, estimating and negotiation of changes to the contract, update of submission requirements, scheduling, manpower and equipment requirements, and direct communication and co-ordination with Abatement Consultant and Owner's representative.

.2 Provide on site, in addition to the Overall Superintendent(s), and for each work shift, a Shift Superintendent, who has authority regarding all aspects related to manpower, equipment and production.

.3 Supervisory personnel must hold a recognized certificate proving attendance at an asbestos removal training course (3-day minimum duration) and have performed supervisory functions on at least five (5) other asbestos abatement projects of similar size and complexity.

.4 At all times during work, the Overall or Shift Superintendent(s) must be on site. Failure to comply with this requirement will result in a stoppage of all work, at no cost to the Owner.

.5 Replace supervisory personnel, with approved replacements, within three (3) working days of a written request from the Owner. Owner reserves the right to request replacement of supervisory personnel without explanation.

.6 Do not replace supervisory personnel without written approval from the Owner.

1.9 Notification

.1 Not later than 5 days before commencing asbestos abatement work on this project, notify the local office of the Manitoba Workplace Safety and Health Division.

.2 Notify Sanitary Landfill site as per local requirements.

.3 Inform all trades on site of the presence and location of hazardous materials identified in the Contract documents.

.4 Notify the Owner or Owner's Representative, if suspected asbestos-containing materials not identified in the contract documents are discovered during the course of the work. Stop work in these areas immediately.

1.10 Submittals

.1 Submit prior to starting work:

Provincial Workers' Compensation Board Clearance Certificate.

Insurance certificates.

Copy of Company Health and Safety Policy and applicable programs.

Provincial Regulator Notice of Project form.

Copy of Certificate of Approval for disposal of hazardous materials waste and location of landfill.

Pre-removal damage survey of the Abatement Work Area(s), waste transport routes, and bin storage areas.

.2 Submit the following information regarding personnel prior to starting work:

Resumes of the supervisory personnel.

Proof in the form of a certificate that supervisory personnel have attended a training course on asbestos (3-day minimum duration).

Written statement that personnel have had instruction on hazards of exposure to hazardous materials identified within this scope, the use of respirator, protective clothing, worker and waste decontamination procedures, and all aspects of work procedures and protective measures.

Written statement that personnel have had instruction on hazards of exposure to hazardous materials identified within this scope, the use of respirator, protective clothing, worker and waste decontamination procedures, and all aspects of work procedures and protective measures.

WHMIS training certificates for all personnel.

Certificate proving that each worker on site has been fit tested for the respirator appropriate for the work being performed.

Proof, satisfactory to the Consultant, that all persons involved in the transport and disposal hazardous materials have been trained in accordance with the requirements of Federal and Provincial Transportation of Dangerous Good Acts and Regulations.

.3 Submit the following information regarding HEPA filtered devices prior to construction of enclosure or asbestos abatement:

Performance data on HEPA filtered vacuums including DOP tests no more than 3 months old.

Performance data on negative air units including DOP tests which must be no more than 3 months old if the unit is vented outdoors or which must be performed on site immediately prior to initial usage and when HEPA filters are changed if the unit is vented indoors.

DOP tests to be performed by an independent testing company.

.1 DOP testing company is required to submit a detailed technical report of testing protocol, including Introduction, Methodology, Results, Conclusions, and Recommendations, including results of the Air-Aerosol Mixing Uniformity test as per ASME N510-1989 (1995).

.2 DOP testing company must also provide calibration certificates from an independent calibration firm or from the manufacturer of the testing equipment for both the aerosol photometer and the pressure gauge on the aerosol generator dated within 1 calendar year from the on-site testing date.

.3 DOP testing company must also provide the National Sanitation Foundation (NSF) certification name and number of the on-site

technician performing the testing.

Proof of calibration of DOP testing equipment.

.4 Submit the following prior to isolating the work area:

Safety Data Sheets for chemicals or material used in the course of the Abatement Project.

.5 Submit the following upon completion of the work.

Manifests, waybills, bills of ladings etc. as applicable for each type of waste.

1.11 Insurance

.1 Maintain a Commercial General Liability Policy with an insurance company acceptable to Pinchin Ltd. and OWNER. The intent of this policy is to hold Pinchin Ltd. and OWNER harmless as it relates to claims for Bodily Injury or Property Damage or both, relating to the contract. Commercial General Liability insurance shall be provided on an "occurrence" basis to cover injury or damage (whether detected or not during the policy period) which happens during the policy period.

.2 Maintain an Automobile or Fleet Policy, and Non-owned Automobile Policy with an insurance company acceptable to Pinchin Ltd. and OWNER. The intent of these policies is to hold Pinchin Ltd. and OWNER harmless as it relates to claims for Bodily Injury or Property Damage or both, relating to the contract.

.3 Maintain a Pollution Liability Policy (or asbestos/lead liability policy or specific coverage under the CGL for asbestos/lead abatement) with an insurance company acceptable to Pinchin Ltd. and OWNER. The intent of this policy is to hold Pinchin Ltd. and OWNER harmless as it relates to claims for Bodily Injury or Property Damage or both, relating to the contract. Pollution Liability shall be provided on an "occurrence" basis to cover injury or damage (whether detected or not during the policy period) which happens during the policy period. Without limiting the generality of the foregoing, the policy shall insure the operations of abatement and shall not contain any environmental and/or health hazard exclusions relating to remediation operations.

.4 Forward all certificates to Pinchin Ltd. and OWNER before work is commenced, showing Pinchin Ltd. and OWNER as additional insured as their interest may appear.

.5 Pinchin Ltd. and OWNER may request a certified true copy of the policies.

.6 The limits will not be less than:

Commercial General Liability	$5,000,000.00
Automobile	$2,000,000.00

Pollution Policy	$5,000,000.00

1.12 Site Review

.1 From commencement of work until completion of clean-up operations, the Abatement Consultant is empowered by the Owner to inspect for compliance with the requirements of governing authorities, adherence to specified procedures and materials, and to inspect for final cleanliness and completion.

.2 The Abatement Consultant is empowered by the Owner to order a shutdown of work when leakage of asbestos from the controlled work area has occurred or is likely to occur.

.3 Any deviation from the requirements of the Specifications or governing authorities that is not approved in writing may result in a stoppage of work, at no cost to the Owner.

.4 Additional labour or materials expended by the Contractor to rectify unsatisfactory conditions and to provide performance to the level specified shall be at no additional cost to the Owner.

.5 Site reviews and air monitoring performed as a result of Contractor's failure to perform satisfactorily regarding quality, safety, or schedule, shall be back charged to the Contractor.

.6 Facilitate site reviews and provide access as necessary. Make good work disturbed by site reviews and testing at no cost to the Owner.

.7 Refer to the Sections identified in Related Work for specified milestone site reviews which are to take place at defined points throughout the abatement operation specific to each phase or work area.

.8 Provide 24 hours written notice to the Abatement Consultant of any request for scheduling of milestone inspections or transportation of waste through Occupied Areas.

.9 The following Milestone Site Reviews may take place, at the Owner's cost:

Milestone Site Review - Clean Site Preparation

.1 Review of preparations and set-up prior to contaminated work in the Abatement Work Area.

Milestone Site Review – Bulk Removal Site Review

.2 Review during asbestos removal, monitoring removal methods, site deficiencies, performing occupied air monitoring, etc.

Milestone Site Review - Visual Clearance

.3 Review of Abatement Work Area after completion of all abatement,

but prior to application of lock-down agents or dismantling of enclosure.

Milestone Site Review – Clearance Sampling

.4 Air monitoring performed following removal of asbestos and application of slow drying sealer to ensure fibre levels inside the enclosure(s) are within the acceptable limits.

.10 Refer to the Sections identified in Related Work for specified milestone site reviews which are to take place at defined points throughout the abatement operation specific to each phase or work area.

.11 Do not proceed with next phase of work until written approval of each milestone is received from the Abatement Consultant.

1.13 Air Monitoring - Asbestos

.1 Air monitoring will be performed using Phase Contrast Microscopy (PCM) following the National Institute for Occupational Safety and Health Method 7400.

.2 Co-operate in the collection of air samples, including providing workers to wear sample pumps for up to full-shift periods. Contractor will be responsible for the cost of testing equipment repairs or resampling resulting from the actions of the Contractor's forces.

.3 Results of PCM samples of 0.05 fibres per cubic centimeter of air (fibre/cc) or greater, outside an Abatement Work Area, or from within the Abatement Work Area during or following Glove Bag Work, will indicate asbestos contamination of these areas. Respond as follows:

Suspend work within the adjoining Abatement Work Area until written authorization to resume work has been received from the Abatement Consultant.

Isolate and clean area in the same manner applicable to the Abatement Work Area.

Maintain work area isolation and repeat clean-up operations until visual inspection and air monitoring results are at a level equal to that specified.

At the discretion of the Abatement Consultant provide additional negative air units at locations specified in response to elevated fibre levels being detected in the Clean Change Room or Occupied Areas.

.4 Results of PCM samples at or greater than 0.01 fibres per cubic centimeter of air (fibre/cc), collected within the Abatement Work Area enclosure after the site has passed a visual inspection, and an acceptable coat of lock-down agent has been applied, will indicate asbestos contamination of these areas. Respond as follows:

Maintain work area isolation and re-clean entire work area. Then apply another acceptable coat of lock-down agent to exposed surfaces throughout the work area.

Repeat above measures until visually inspected and air monitoring results are at a level equal to that specified.

.5 When results exceed 50% of maximum use concentration for the respirator being used within the work area respond as follows:

Immediately stop work within the Abatement Work Area.

Instruct workers to exit the Abatement Work Area via the Worker Decontamination Facility while observing specified personnel exiting procedures.

Contractor's forces shall not re-enter the Abatement Work Area for a period of 8 hours or until authorized by the Abatement Consultant.

Upon re-entry to the Abatement Work Area, mist the air, any fallen debris or exposed surfaces with amended water using an airless sprayer.

.6 Additional labour or materials expended by the Contractor to rectify unsatisfactory conditions and to provide performance to the level specified shall be at no additional cost to the Owner.

.7 Cost of additional inspection and sampling performed as a result of elevated fibre levels in areas outside the Abatement Work Area or from within the work area following completion of work, will be back charged to the Contractor.

1.14 Worker Protection

.1 Instruct workers before allowing entry to the Abatement Work Area. Instruction shall include training in use of respirators, dress, showering, entry and exiting from an Abatement Work Area, and all other aspects of work procedures and protective measures.

.2 Workers shall not eat, drink, chew gum or tobacco, or smoke in the Abatement Work Area.

.3 Workers shall be fully protected at all times when possibility of disturbance of hazardous materials exists.

.4 Provide soap, towels, and facilities for washing of hands and face, which shall be used by all personnel when leaving the Abatement Work Area.

.5 Respiratory Protection

Refer to each particular Section of the Specification for specified type of respiratory equipment specific to each phase or work area.

Respirators shall be:

.1 Certified by the National Institute of Occupational Safety and Health (NIOSH) or other testing agency acceptable to the Provincial regulator.
.2 Fitted so that there is an effective seal between the respirator and the worker's face. Ensure that no person required to enter an Abatement Work Area has facial hair which affects the seal between respirator and face.
.3 Assigned to a worker for their exclusive use.
.4 Maintained in accordance with manufacturer's specifications.
.5 Cleaned, disinfected, and inspected by a competent person after use on each shift, or more often if required.
.6 Repaired or have damaged or deteriorated parts replaced.
.7 Stored in a clean and sanitary location.
.8 Provided with new filters as necessary, according to manufacturer's instructions.
.9 Worn by personnel who have been fit checked by qualitative or quantitative fit-testing.
.10 Instruction on proper use of respirators must be provided by a competent person.

Provide protective clothing, to all personnel which:

.11 Is made of a material that does not readily retain nor permit penetration of asbestos fibres or lead/silica dust.
.12 Consists of head covering and full body covering those fits snugly at the ankles, wrists, and neck.
.13 Once coveralls are worn, treat and dispose of as contaminated waste.
.14 Is replaced or repaired if torn or ripped.

Use hard hats, safety footwear and other protective equipment and apparel required by applicable construction safety regulations.

1.15 Visitor Protection

.1 Provide clean protective clothing and equipment to Authorized Visitors.

.2 Instruct Authorized Visitors in the use of protective clothing and Abatement Work Area entry and exit procedures.

.3 Authorized visitors are required to be fit tested on respirators, prior to entering Abatement Work Area.

1.16 Signage

.1 Asbestos Abatement Signs: Post signs at access points to the Abatement Work Area, stating at minimum, the following:

There is an asbestos dust hazard.

Access to the work area is restricted to persons wearing protective clothing and equipment.

.2 Lead Abatement Signs: Post signs at access points to the Abatement Work Area, stating at minimum, the following:

There is a lead dust, fume, or mist hazard.

Access to the work area is restricted to authorized persons.

Respirators must be worn in the work area.

.3 Bins and Asbestos Waste Containers: Post signs on both sides of every asbestos waste container. Signs must display thereon in large, easily legible letters that contrast in colour with the background the word “CAUTION” in letters not less than ten centimetres in height and the words:

CONTAINS ASBESTOS FIBRES

Avoid Creating Dust and Spillage

Asbestos May be Harmful To Your Health

Wear Approved Protective Equipment.

.4 Place placards in accordance with Transportation of Dangerous Goods Act.

1.17 Differential Pressure Monitoring

.1 Provide and install differential pressure monitors as specified in each section.

.2 Replace damaged or non-functional equipment at the request of the Abatement Consultant.

.3 Record at minimum twice daily, and when damage to the enclosure is identified and repaired, the following information:

- .1 Name of inspector.
- .2 Date and time.
- .3 Pressure reading.
- .4 Repairs completed, if applicable.

.4 Maintain specified differential pressure.

.5 Stop contaminated work and take corrective action if pressure differential drops below the specified level. Notify the Abatement Consultant immediately.

1.18 Waste and Material Handling

.1 Waste bins must be placed on grade or in receiving.

.2 All bins for hazardous materials must be covered and locked when waste transfer is not being performed.

.3 Ensure redundant non-ACM, rubble, debris, etc. removed during contaminated work are treated, packaged, transported, and disposed of as appropriate waste.

.4 Clean, wash and apply Post Removal Sealant to metal waste prior to removal from Abatement Work Area. Recycle metals.

.5 Clean, wash and apply Post Removal Sealant to non-porous materials prior to disposal as clean waste. Obtain prior written approval from the Abatement Consultant for each individual type of material.

.6 Clean and wash equipment prior to removal from Abatement Work Area if removed prior to completion.

.7 Place all equipment, tools and unused materials that cannot be cleaned in Abatement Waste Containers.

.8 As work progresses, and at regular intervals, transport the sealed and labelled waste containers from the Abatement Work Area to waste bin.

.9 Place items in bins according to waste classification. Place asbestos waste, lead waste, metals, non-asbestos waste, etc. in separate bins.

.10 Removal of waste containers and decontaminated tools and materials from the Abatement Work Area shall be performed as follows:

Remove any visible contamination from the surface of non-porous or cleanable waste being removed from the Abatement Work Area. If the item can be cleaned, remove it from the site as clean waste.

Place waste or item in Waste Container and seal closed.

Wet wipe outside of Waste Container.

Within Decontamination Facility, Transfer Room or at the perimeter of the Abatement Work Area, place in second Waste Container. Seal closed.

Remove waste containers and transport to appropriate bin.

.11 Transport waste and materials via the predetermined routes and exits. Arrange waste transfer route with Owner. Use a closed, covered cart to transport through Occupied Areas.

.12 Use Low Risk Procedures while transporting asbestos waste through facility.

.13 Provide workers transporting waste with means to access full personal protective equipment and all tools required to properly clean up spilled material in the case of a rupture of a Waste Container.

.14 Pick-up and drop off of garbage bin shall be at pre-approved times and must not interfere with the Owners operations.

.15 Transport hazardous waste to landfill or waste transfer station in accordance with provincial requirements.

.16 Cooperate with inspectors from the provincial regulator and immediately carry out instructions for remedial work at dump to maintain environment, at no additional cost to the Owner.

1.19 Re-establishment of Objects and Systems

.1 Re-establish objects and items relocated by the Contractor's workforce to facilitate work.

.2 Re-establish electrical, communication, HVAC, and other services previously disconnected or otherwise isolated to accommodate work by this Section.

.3 Make good at completion of work, all damage not identified in pre-removal survey.

PART 2 PRODUCTS AND FACILITIES

2.1 Materials and Equipment

.1 Refer to the Sections identified in Related Work for specified materials, equipment, or facilities specific to each phase or work area.

.2 Materials and equipment must be in good condition and free of debris and fibrous materials. Disposable items must be of new materials only.

.3 Airless Sprayer: AC powered pressure washer that allows wetting agent to mix with water, uses no air or compressed air, and has a nozzle to regulate power and pressure.

.4 Amended Water: Water with wetting agent added for purpose of reducing surface tension to allow thorough wetting of materials.

.5 Asbestos Waste Container: A container acceptable to disposal site, and the provincial regulator comprised of the following:

Dust tight.

Suitable for the type of waste.

Impervious to asbestos.

Identified as asbestos waste.

.6 Differential Pressure Monitor: a high precision instrument for measuring and controlling pressure differences in the low range, between the Abatement Work Area and Occupied Area. Calibrate regularly to manufacturer's instructions.

.7 Discharge Ducting: Polyethylene Tubing. Reinforced with wire. Diameter to equal negative pressure machine discharge. Not to be longer than required, or so long that negative pressure is compromised.

.8 Ground Fault Panel: Electrical panel as follows:

Ground fault circuit interrupters of sufficient capacity to power temporary electrical equipment and lights in Asbestos Work Area.

Interrupters to have a 5-mA ground fault protection.

Necessary accessories including main switch disconnect, ground fault interrupter lights, test switch to ensure unit is working, and reset switch.

Openings sealed to prevent moisture or dust penetration.

Inspected by the Electrical Safety Authority.

Panel uses CSA approved parts and been constructed, inspected, and installed by a licensed electrician.

Provide one Ground Fault Panel for each 5,000 square feet (500 square metres) of Abatement Work Area.

.9 HEPA Filtered Negative Pressure Machine: Portable air handling system which extracts air directly from the Abatement Work Area and discharges the air to the exterior of the building. Equipped as follows:

Prefilter and HEPA filter. Air must pass HEPA filter before discharge.

Pressure differential gauge to monitor filter loading.

Auto shut off and warning system for HEPA filter failure.

Separate hold down clamps to retain HEPA filter in place during change of prefilter.

.10 HEPA Vacuum: Vacuum with necessary fittings, tools, and attachments. Discharged air must pass through a HEPA filter.

.11 Hose: Leak-proof, minimum busting strength of 500 PSI or greater if required, abrasion resistant covering, reinforcing, and machined-brass couplings. Maintained and tested. Hose to be temperature resistant if it is to carry domestic hot water.

.12 Lead Waste Container: An impermeable container acceptable to disposal site and provincial regulator, that is:

Dust tight.

Suitable for the type of waste.

Evaluated for leachable lead content and disposed of in accordance with applicable regulations.

.1 Where lead waste exceeds 5.0 mg/L of lead in the TCLP analysis, label as lead waste and dispose of as leachate toxic hazardous waste.

.2 Where lead waste is below 5.0 mg/L of lead in the TCLP analysis, disposed of as construction waste.

.13 OSB: Oriented Strand Board.

.14 Polyethylene Sheeting: 6 mil (0.15 mm) minimum thickness unless otherwise specified, in sheet size to minimize joints.: 6 mil (0.15 mm) minimum thickness unless otherwise specified, in sheet size to minimize joints.

.15 Post Removal Sealant (or Lockdown): Sealant that when applied to surfaces serves the function of trapping residual asbestos fibres or other dust. Product must have flame spread and smoke development ratings both less than 50. Product shall leave no stain when dry. Post Removal Sealant shall be compatible with replacement insulation or fireproofing where required and capable of withstanding service temperature of substrate. Apply to manufacturer's instructions.

.16 Protective Clothing: Disposable coveralls complete with head covering and full body covering those fits snugly at the ankles, wrists, and neck.

.17 Rip-Proof Polyethylene Sheeting: 8 mil (0.20 mm) fabric made up from 5 mil (0.13 mm) weave and two (2) layers of 1.5 mil (0.05 mm) poly laminate or approved equal. In sheet size to minimize on-site seams and overlaps.

.18 Shower Hose: Water lines for supply of hot & cold water to shower facilities to be rated for use at 200 PSI (1380 kPa) or twice the working pressure whichever is greater. Supply lines to be continuous and free of fittings, joints, or couplings.

.19 Sprayer: Garden type portable manual sprayer or water hose with spray attachment if suitable.

.20 Tape: Duct tape or tape suitable for sealing polyethylene to surfaces under both dry and wet conditions in the presence of Amended Water.

.21 Wetting Agent: Non-sudsing surfactant added to water to reduce surface tension and increase wetting ability.

PART 3 EXECUTION

.1 Refer to the Sections identified in Related Work for specified procedures for work area preparation, maintenance, site dismantlement, application of lock-down agent and all other procedures for the safe handling, removal, and clean-up of hazardous materials specific to each phase or work area.

END OF SECTION

PART 1 GENERAL

1.1 General and Related Work

.1 Read this Section in conjunction with all drawings and all other Sections so as to comply with the requirements of Division 1 and the General Conditions of the Contract.

.2 Requirements specified elsewhere:

.1 Section 02 81 00 Hazardous Materials – General Provisions

1.2 Outline of Work

.1 Refer to Section 02 81 00 Hazardous Materials – General Provisions for the Outline of Work.

.2 Isolate the Abatement Work Area from adjoining spaces through the installation of temporary barriers and partitions as specified herein.

.3 The intent of this Section is to provide safe work practices and procedures to govern the handling, removal, clean-up, and disposal of asbestos-containing materials following Type 1 (Low Risk) procedures, and Pinchin and Owner specific requirements.

1.3 Instruction and Training

.1 Provide instruction and training to all workers including the following:

.1 Hazards of asbestos.

.2 Use, care, and disposal of protective equipment (including but not limited to respirators and filters) and clothing that would be used and worn during abatement work, including:

.1 Limitations of equipment.

.2 Inspection and maintenance of equipment.

.3 Proper fitting of equipment.

.4 Disinfecting and cleaning of equipment.

.3 Personal hygiene to be observed when performing the work.

.4 Measures and procedures prescribed in the regulation and decontamination of the worker.

.2 Instruction and training must be provided by a competent person.

1.4 Personal Protection

.1 Protect all personnel at all times when possibility of disturbance of ACM exists.

.1 Provide non-powered half-face respirators with P100 high efficiency (HEPA) cartridge filters when requested by personnel.

.2 When requested by personnel, provide protective clothing.

1.5 Inspections

.1 Refer to Part 1.12 Inspections in Section 02 81 00 – General Provisions.

.2 The following Milestone Inspections are to be scheduled:

.1 Milestone Inspection - Visual Clearance

.2 Milestone Inspection – Clearance Sampling

PART 2 PRODUCTS AND FACILITIES

.1 Refer to Section 02 81 00.

PART 3 EXECUTION

3.1 Site Preparation

.1 Moving of equipment, tools, supplies, and stored materials that can be performed without disturbing ACM will be performed by others.

.2 Remove visible dust and friable material from all surfaces in the work area including those to be worked on, using HEPA Vacuums or wet wiping.

.3 Install polyethylene drop sheets below areas of work.

.4 Install signage in clearly visible locations and in sufficient numbers to adequately warn of an asbestos dust hazard.

.5 Isolate, at panel, and disconnect existing power supply to Abatement Work Area. Power supply to remaining areas of building must not be disrupted during work of this section.

.1 Lock-out/tag-out power at electrical panels.

.2 Mark/tag any items within or passing through the Abatement Work Area that are to remain live including but not limited to cable, conduit, wire, fixtures, equipment panels, etc.

.6 Shut down HVAC systems serving the Abatement Work Area.

.1 Install polyethylene sheeting over openings in ducts and diffusers and seal.

.2 HVAC to remaining areas of building must not be disrupted during work of this section.

.3 System shall remain inoperative until completion of work unless ducts can be effectively capped.

.4 Perform work at scheduled times after shutting down HVAC systems affecting the Abatement Work Area.

.7 Provide power from ground fault interrupt circuits.

.8 Provide amended water for wetting ACM, and adequate method of wetting (garden sprayers, airless sprayers, etc.).

.9 Do not commence contaminated work until authorized by the Abatement Consultant.

3.2 Maintenance of Abatement Work Area

.1 Inspect polyethylene sheeting and ensure it is effectively sealed and taped. Repair damage and remedy defects immediately.

.2 Inspect electrical panels and ensure locks and tags are on panels prior to entering the Abatement Work Area.

.3 Maintain Abatement Work Area in tidy condition.

.4 Remove any standing water on polyethylene/floor at the end of every shift.

3.3 Asbestos Removal - General

.1 Do not use powered tools or non-handheld tools.

.2 Do not use compressed air to clean or remove dust or debris.

.3 Do not break, cut, drill, abrade, grind, sand or vibrate ACM if it cannot be wetted. Type 2 (Moderate Risk) procedures would be required if the material cannot be wetted due to hazard or damage.

.4 Wet ACM prior to work and keep ACM wet throughout the removal process.

.5 Frequently and at regular intervals during the work, clean up dust and waste using HEPA vacuums and/or wet sweeping or mopping.

.6 Frequently and at regular intervals, place all waste in asbestos waste containers.

.7 Immediately upon completion of work, clean area with HEPA vacuum and/or wet sweeping or mopping.

3.4 Asbestos Removal - Vinyl Asbestos Tile

.1 Wedge a heavy-duty scraper in seam of two adjoining tiles and gradually force edge of one tile up and away from floor. Do not break off pieces of tile but continue to force balance of tile up.

.2 Place tile, without breaking into smaller pieces, into Asbestos Waste Container.

.3 Force scraper through tightly adhered areas by striking scraper handle with a hammer.

.4 Heat tile thoroughly with a hot air gun until heat penetrates through tile and softens adhesive in areas where scraper will not remove tile.

.5 Scrape up adhesive remaining on floor with a hand scraper until only a thin smooth film remains.

.6 Use a hot air gun where deposits are heavy or difficult to scrape.

.7 Deposit scrapings into asbestos waste disposal bag.

.8 HEPA vacuum floor on completion of work in area.

3.5 Asbestos Removal – Red Duct Mastic

.1 Use the procedures described above under *Site Preparation –No Enclosure Required*.

.2 Remove ducts in sections while avoiding cutting through mastic. If cutting through mastic is unavoidable do not use power tools to cut through mastic.

.3 Wrap sections of ducts with two layers of rip proof polyethylene.

.4 Wet clean or HEPA vacuum the entire Abatement Work Area, including surfaces not covered with polyethylene sheeting. Any materials or equipment removed to access ACM that are to be reused, must be wet cleaned or vacuumed prior to reinstatement.

3.6 Asbestos Removal – Black Duct Mastic

.1 Use the procedures described above under *Site Preparation –No Enclosure Required*.

.2 Remove insulation on ducts that has asbestos black mastic on the jacketing in sections using non-powered hand tools.

.3 Place removed ACM directly into an asbestos waste container.

.4 Wet clean or HEPA vacuum the entire Abatement Work Area, including surfaces not covered with polyethylene sheeting. Any materials or equipment removed to access ACM that are to be reused, must be wet cleaned or vacuumed prior to reinstatement.

3.7 Asbestos Removal - Removal Asbestos Transite Boards

.1 Wet all material to be disturbed.

.2 Undo fasteners if necessary to remove material.

.3 Break material only if unavoidable, and wet material if broken during work.

.4 Use only non-powered hand-held tools to remove ACM.

.5 Scrape to remove material adhered to substrate.

.6 Place removed ACM directly into an asbestos waste container.

.7 Wet clean or HEPA vacuum the entire Abatement Work Area, including surfaces not covered with polyethylene sheeting. Any materials or equipment removed to access ACM that are to be reused, must be wet cleaned or vacuumed prior to reinstatement.

3.8 Abatement Work Area Dismantling

.1 Do not commence site dismantlement until authorized by the Asbestos Abatement Consultant.

.2 Wash or HEPA vacuum equipment and tools used in contaminated Abatement Work Area to remove all asbestos contamination, or place in Asbestos Waste Containers prior to being removed from Abatement Work Area.

.3 Place tools and equipment used in contaminated work site but not cleaned in polyethylene bags prior to removal from Abatement Work Area.

.4 Clean polyethylene sheeting and drop sheets with HEPA vacuum or wet cleaning methods at completion of work.

.5 Wet drop sheets and polyethylene sheeting.

.6 Carefully roll polyethylene sheeting and drop sheets toward the centre. As polyethylene is rolled away, immediately remove visible debris beneath with a HEPA vacuum.

.7 Remove remaining polyethylene sheeting and tape.

.8 Place polyethylene sheeting, drop sheets, tape, disposal clothing and other contaminated waste in asbestos waste containers, wet wipe, and place in second asbestos waste container.

3.9 Waste and Material Handling

.1 Refer to Section 02 81 00.

END OF SECTION

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PART 1 GENERAL

1.1 General and Related Work

.1 Read this Section in conjunction with all drawings and all other Sections so as to comply with the requirements of Division 1 and the General Conditions of the Contract.

.2 Requirements specified elsewhere:

.1 Section 02 81 00 Hazardous Materials – General Provisions

1.2 Outline of Work

.1 Refer to Section 02 81 00 Hazardous Materials – General Provisions for the Outline of Work.

.2 The intent of this Section is to provide safe work practices and procedures to govern the handling, removal, clean-up, and disposal of asbestos-containing materials following Type 2 or Moderate Risk procedures, and Pinchin and Owner specific requirements.

.3 Isolate the Asbestos Work Area from adjoining spaces through the installation of specified hoardings, seals, and enclosures at the perimeter of each phase or work area.

.4 Install Hoarding Walls between Abatement Work Area boundaries.

1.3 Instruction and Training

.1 Provide instruction and training to all workers including the following:

.1 Hazards of asbestos.

.2 Use, care, and disposal of protective equipment (including but not limited to respirators and filters) and clothing that would be used and worn during abatement work, including:

.1 Limitations of equipment.

.2 Inspection and maintenance of equipment.

.3 Proper fitting of equipment.

.4 Disinfecting and cleaning of equipment.

.3 Personal hygiene to be observed when performing the work.

.4 The measures and procedures prescribed by this section including decontamination of the worker.

.5 Instruction and training must be provided by a competent person.

1.4 Personal Protection

.1 Protect all personnel at all times when possibility of disturbance of ACM exists.

.1 Provide workers, at a minimum, with full face respirators with P100 high efficiency (HEPA) cartridge filters, for work inside a negative pressure enclosure.

.2 Provide protective clothing, to all personnel entering the Abatement Work Area.

.3 Wear hard hats, safety shoes and other personal protective equipment required by applicable construction safety regulations.

1.5 Inspections

.1 Refer to Part 1.12 Inspections in Section 02 81 00 – General Provisions.

.2 The following Milestone Site Reviews are to be scheduled:

.1 Milestone Review - Clean Site Preparation

.2 Milestone Review – Bulk Removal Review

.1 Milestone Review - Visual Clearance

.2 Milestone Review – Clearance Sampling

PART 2 PRODUCTS AND FACILITIES

.1 Refer to Section 02 81 00.

2.1 Hoarding Walls

.1 Type A Hoarding Wall: 38 mm x 89 mm wood or metal studs at 400 mm o/c with continuous sill and top plate, covered with one layer of rip-proof polyethylene sheeting on each side of wall.

2.2 Transfer Room

.1 Transfer Room to be generally 2000 mm x 2000 mm x 2200 mm high. Increase size accordingly to accommodate number of workers.

.2 Install walls as follows:

.1 Install 38 x 89 mm wood framing at 610 mm o/c with continuous top and sill plates.

.2 Install one layer rip-proof polyethylene sheeting on each side of walls of Transfer Room.

.1 Install one layer of rip-proof polyethylene sheeting over two layers of 6 mil polyethylene sheeting beneath entire Transfer Room.

.2 Install two layers of rip-proof polyethylene sheeting over roof.

.3 Turn 600 mm of polyethylene down the sides over polyethylene on the perimeter walls.

.4 Install a fire extinguisher, mount to wall.

2.3 Curtained Doorways

.5 Construct as follows:

.1 Install two flap doors, full width and height of door opening at all doors to Abatement Work Area and both ends of Transfer Room.

.2 Construct each flap door of two layers of polyethylene sheeting with all edges reinforced with tape. Use wood strapping to securely fasten flap doors to head and alternate jambs.

.3 Install weights attached to bottom edge of each door flap.

.4 Provide direction arrows on flaps to indicate opening.

PART 3 EXECUTION

3.1 Site Preparation - General

.1 Moving of equipment, tools, supplies, and stored materials that can be performed without disturbing ACM will be performed by others.

.2 Remove visible dust and friable material from all surfaces in the work area including those to be worked on, using HEPA Vacuums or wet wiping.

.3 Isolate, at panel, and disconnect existing power supply to Abatement Work Area. Power supply to remaining areas of building must not be disrupted during work of this section.

.1 Lock-out/tag-out power at electrical panels.

.2 Mark/tag any items within or passing through the Abatement Work Area that are to remain live including but not limited to cable, conduit, wire, fixtures, equipment panels, etc.

.4 Shut down HVAC systems serving the Abatement Work Area.

.1 Install polyethylene sheeting over openings in ducts and diffusers and seal.

.2 HVAC to remaining areas of building must not be disrupted during work of this section.

.3 System shall remain inoperative until completion of work unless ducts can be effectively capped.

.4 Perform work at scheduled times after shutting down HVAC systems affecting the Abatement Work Area.

.5 Provide power from ground fault interrupt circuits.

.6 Provide amended water for wetting ACM, and adequate method of wetting (garden sprayers, airless sprayers, etc.).

3.2 Site Preparation –Enclosure Required

.1 Install polyethylene enclosure.

.2 Install Transfer Room.

.3 Construct Type A Hoarding Walls between Abatement Work Area perimeter and occupied areas.

.4 Install Curtained Doorways.

.5 Seal openings in floor using tape, caulking, polyethylene, etc. Floor openings are to be sealed independently prior to installation of floor polyethylene.

.6 Install polyethylene sheeting on floors of Abatement Work Area. Use sufficient layers to provide adequate protection for carpeting and equipment.

.1 Minimum requirement over carpet is one layer of 6 mil polyethylene under one layer of rip-proof polyethylene.

.2 Cover floors first so that polyethylene on walls is overlapped by at least 305 mm.

.7 Install polyethylene sheeting at openings in walls (as required) and seal.

.8 Install 6 mil polyethylene sheeting on walls within the Abatement Work Area., including existing walls that make up, or are within, the Abatement Work Area.

.9 Install one layer of 6 mil polyethylene sheeting so as to protect all equipment and finishes in the Abatement Work Area that may be damaged. Items to remain include but are not limited to:

- .1 Millwork.
- .2 Doors.
- .3 Bulkheads.
- .4 Plumbing fixtures.
- .5 Electrical Equipment.

.10 Provide a completely sealed polyethylene top for free standing enclosures.

.11 Extend to underside of ceiling system, enclosures for access into ceilings.

.12 Install temporary lighting in enclosure to a level that will provide for safe and efficient use of work area - minimum 550 LUX.

.13 Establish negative pressure in Abatement Work Areas as follows:

- .1 Provide sufficient HEPA filtered negative pressure machines to exchange a volume of air equivalent to that of the Abatement Work Area a minimum of every 20 minutes.
- .2 Provide additional HEPA filtered negative pressure machines as required to ensure air flow from Occupied Area into Abatement Work Area.
- .3 Arrange negative air units to maximize the distance between units and decontamination facilities.
- .4 Operate HEPA filtered negative pressure machines continuously from first disturbance of ACM until completion of dismantling.
- .5 Replace prefilters to maintain specified flow rate.
- .6 Replace HEPA filter as required to maintain flow rate and integrity of unit.
- .7 Discharge HEPA filtered negative air machines as follows:
  - .1 To building exterior.
    - .1 Remove existing glazing where necessary and replace with a 19 mm plywood panel.
    - .2 Install panel securely in window frame so that it cannot be pushed into the building and make weather-tight with caulking.
    - .3 For each negative pressure unit, provide a 300 mm diameter, screened, duct opening through panel.
    - .4 Direct discharge away from building access points.
    - .5 Reinstall glazing to match existing upon completion of work.

.14 Place required tools to complete the abatement with the Abatement Work Area.

.15 Install Signage in clearly visible locations and in sufficient numbers to adequately warn of an asbestos dust hazard.

.16 Schedule and obtain written approval of Milestone Site Review - Clean Site Preparation before proceeding.

3.3 Maintenance of Abatement Work Area

.1 Inspect polyethylene sheeting and ensure it is effectively sealed and taped. Repair damage and remedy defects immediately.

.2 Inspect electrical panels and ensure locks and tags are on panels prior to entering the Abatement Work Area.

.3 Inspect HEPA filtered negative pressure machines including discharge ducting at the beginning and end of each working period. Inspection must be performed by competent person.

.4 Maintain Abatement Work Area in tidy condition.

.5 Remove standing water on polyethylene/floor at the end of every shift.

.6 Turn off water supply to any hoses and reduce pressure in hose, prior to leaving the Abatement Work Area at end of shift.

3.4 Asbestos Removal - General

.1 Do not use compressed air to clean or remove dust or debris.

.2 Frequently and at regular intervals during the work, clean up dust and waste using HEPA vacuums and/or wet sweeping or mopping.

.3 Frequently and at regular intervals, place all waste in asbestos waste containers.

.4 Immediately upon completion of work, clean area with HEPA vacuum and/or wet sweeping or mopping.

3.5 Asbestos Removal - Drywall with Asbestos Drywall Joint Compound (Less than 3 hours)

.1 Use the procedures described above under *Site Preparation –Enclosure Required*.

.2 Protect drywall around area to be removed by covering with polyethylene and taping seams to wall.

.3 Cut drywall and remove using non-powered hand-held tools. Place directly into polyethylene waste bag, or sealed container until at waste bin.

.4 Remove all screws and fasteners in studs or strapping.

.5 Remove studs and strapping where specified. Clean metal studs and remove from Abatement Work Area.

.6 Wet clean or HEPA vacuum the entire Abatement Work Area, including surfaces not covered with polyethylene sheeting. Any materials or equipment removed to access ACM that are to be reused, must be wet cleaned or vacuumed prior to reinstatement.

.7 Schedule and obtain written approval of Milestone Site Review – Clearance Sampling before proceeding.

3.6 Application of Post Removal Sealant

.1 Apply one coat of Post Removal Sealant with an airless sprayer, in accordance with Manufacturer's Instructions, to cover all surfaces on all items in the Abatement Work Area, including but not limited to polyethylene, ACM substrate, structural steel, and surfaces scheduled for demolition.

.2 Do not apply post removal sealant to materials that will be damaged by its application.

3.7 Abatement Work Area Dismantling

.1 Do not commence site dismantlement until authorized by the Abatement Consultant.

.2 Wash or HEPA vacuum equipment and tools used in contaminated Abatement Work Area to remove all asbestos contamination, or place in Asbestos Waste Containers prior to being removed from Abatement Work Area.

.3 Place tools and equipment used in contaminated work site but not cleaned in polyethylene bags prior to removal from Abatement Work Area.

.4 Clean polyethylene sheeting and drop sheets with HEPA vacuum or wet cleaning methods at completion of work.

.5 Wet drop sheets and polyethylene sheeting.

.6 Carefully roll polyethylene sheeting and drop sheets toward the centre of enclosure. As polyethylene is rolled away, immediately remove visible debris beneath with a HEPA vacuum.

.7 Remove remaining polyethylene sheeting and tape and dispose of as asbestos waste.

.8 Place polyethylene sheeting, drop sheets, tape, disposal clothing and other contaminated waste in asbestos waste containers, wet wipe, and place in second asbestos waste container.

.9 Remove remaining site isolation, seals, tape, etc.

.10 Remove Transfer Room.

.11 Remove seals, tape, Signage etc.

.12 Immediately upon shutting down negative air units, seal air inlet grill and exhaust vent with polyethylene and tape.

.13 Seal openings in HEPA vacuums.

.14 Remove and dispose of the pre-filters from HEPA filtered negative pressure machines as asbestos waste.

.15 Remove HEPA filtered negative pressure machines and discharge ducting or HEPA vacuums.

.16 Remove temporary lights.

.17 Remove ground fault panels.

.18 Place contaminated materials including polyethylene sheeting, drop sheets, seals, tape, disposable coveralls, and other contaminated waste in asbestos waste containers.

3.8 Waste and Material Handling

.1 Refer to Section 02 81 00.

END OF SECTION

PART 1 GENERAL

1.1 General and Related Work

.1 Read this Section in conjunction with all drawings and all other Sections so as to comply with the requirements of Division 1 and the General Conditions of the Contract.

.2 Requirements specified elsewhere:

.1 Section 02 81 00 Hazardous Materials – General Provisions

1.2 Outline of Work

.1 Refer to Section 02 81 00 Hazardous Materials – General Provisions for the Outline of Work.

.2 Install Hoarding Walls between Abatement Work Area boundaries.

.1 Install Type A Hoarding Walls between the Abatement Work Area and unoccupied and occupied areas.

.3 Using Type 3 (High Risk) procedures of this section, remove and dispose of the following:

.1 Drywall where removal will take greater than 3 hours.

1.3 Personal Protection

.1 Protect all personnel at all times when possibility of disturbance of ACM exists.

.2 Provide the following respiratory protection to all personnel:

.1 Full Face Air Purifying Respirators with P100 high efficiency (HEPA) cartridge filters during projects when performing wet abatement asbestos-containing or contaminated materials specified in this section.

.2 Non-powered half-face respirators with P100 high efficiency (HEPA) cartridge filters for dismantling of Type 3 [High Risk] enclosures, using Type 2 [Moderate Risk] Procedures.

.3 Provide protective clothing, to all personnel entering the Abatement Work Area.

.4 Wear hard hats, safety shoes and other personal protective equipment required by applicable construction safety regulations.

1.4 Differential Pressure Monitoring

.1 Install differential pressure monitor at a location chosen by the Abatement Consultant.

.2 Co-operate with the Abatement Consultant in collection of pressure monitoring data.

.3 Maintain specified differential pressure at monitoring location. Negative air pressure is to be -0.02 inches of water, relative to the area outside the enclosed area.

1.5 Site Reviews

.1 Refer to Part 1.12 Site Reviews in Section 02 81 00 – General Provisions.

.2 The following Milestone Site Reviews are to be scheduled:

.1 Milestone Review - Clean Site Preparation

.2 Milestone Review – Bulk Removal Review

.3 Milestone Review - Visual Clearance

.4 Milestone Review – Clearance Sampling

PART 2 PRODUCTS AND FACILITIES

2.1 Materials and Equipment

.1 Refer to Section 02 81 00.

2.2 Hoarding Walls

.1 Type A Hoarding Wall: 38 mm x 89 mm wood or metal studs at 400 mm o/c with continuous sill and top plate, covered with one layer of rip-proof polyethylene sheeting on each side of wall.

2.3 Decontamination Facilities

.1 Workers' Decontamination Facility: A decontamination facility comprised of three linked rooms, Contaminated Change Room, a Shower Room, and a Clean Change Room.

.1 Rooms, Occupied Areas, and Abatement Work Areas shall be separated by curtained doorways at each door.

.2 Contaminated Change Room: Room between Shower Room and Abatement Work Area.

.1 Locate on contaminated side of Shower Room.

.2 Install asbestos waste container for asbestos contaminated protective clothing.

.3 Install storage facilities for any personal protective equipment to be reused in Abatement Work Area including boots, hard hats, etc., but excluding respirators.

.4 Install hooks and shelves as required for personal protective equipment.

.5 Minimum size of generally 2 m x 2 m. Increase size accordingly to accommodate number of workers.

.3 Shower Room: Room between Clean Change Room and Contaminated Change Room.

.1 Install one walk through shower unit for every six workers.

.2 Install constant supply of hot and cold water, controllable at each shower. Water supply must be sufficient to provide water at a minimum temperature of 40 degrees Celsius (maximum 50 degrees) in a volume required for all workers to properly decontaminate.

.1 Install individual hot and cold shut-off valves on water supply located on clean side of Shower Room. Connect shower to these valves.

.2 Install individual controls inside the shower to regulate water flow and temperature.

.3 Install rigid piping or Shower Hose with watertight connections for supply and drains.

.4 Install a sealed drip pan under and around the showers, 150 mm deep.

.5 Install sump pumps, sufficient for volume of waste shower water from showers and drip pan. Direct waste shower water to sanitary drains.

.6 Install ground fault protected power switch on clean side of shower for sump pumps or timed for shut off.

.7 Provide adequate quantity of soap, shampoo, clean towels.

.8 Install an Asbestos Waste Container for disposal of used respirator filters, on the contaminated side of the Shower Room.

.4 Clean Change Room: A room between the Shower Room and Occupied Areas.

.1 Install hooks and shelves on clean side of shower in clean Change Room for storage of respirators.

.2 Install lockers or hangers for workers' street clothes and personal belongings.

.3 Provide ground fault protected power supply to sump pump, battery chargers.

.4 Install a fire extinguisher, mount to wall.

.5 Minimum size of generally 2m x 2m. Increase size accordingly to accommodate number of workers.

.5 Waste and Equipment Decontamination Facility: Waste and Equipment Decontamination Facility comprised of three linked rooms: a Container Cleaning Room, a Holding Room, and a Transfer Room.

.1 Purpose of Waste and Equipment Decontamination Facility is to provide a means to decontaminate asbestos waste containers, scaffolding, vacuums, and other tools and equipment and materials required in the Abatement Work Area.

.2 Rooms, Occupied Areas, and Abatement Work Areas shall be separated by curtained doorways at each door.

.6 Container Cleaning Room: Room between Abatement Work Area and Holding Room of sufficient size to allow proper washing of equipment and waste containers or double bagging of asbestos waste. All wash water shall be treated as asbestos contaminated waste.

.7 Holding Room: Room between Container Cleaning Room and Transfer Room, of sufficient size to accommodate at least two asbestos waste containers and two workers double bagging waste, or for largest item of equipment used.

.1 Install a fire extinguisher mounted to wall.

.8 Transfer Room: Room between Holding Room and Occupied Area, acting as an air lock for the transfer of waste.

.9 Construction of Decontamination Facilities

.1 Install floor protection as follows:

.1 Install one layer of rip-proof polyethylene sheeting over two layers of 6 mil polyethylene sheeting beneath entire decontamination facility.

.2 Turn 600 mm of polyethylene up the sides of the decontamination facility and overlap with the polyethylene sheeting covering the walls.

.2 Install walls as follows:

.1 Around all rooms, between all rooms, at entrance to Abatement Work Area and at entrance to Occupied Area.

.2 Install 38 x 89 mm wood framing at 610 mm o/c with continuous top and sill plates.

.3 Install one layer rip-proof polyethylene sheeting on interior walls of Decontamination Facility.

.4 Install one layer rip-proof polyethylene sheeting both sides on interior dividing walls of Decontamination Facility.

.5 Install one layer rip-proof polyethylene sheeting over one layer of 6 mil polyethylene sheeting on walls exposed to the Abatement Work Area.

.6 Install one layer rip-proof polyethylene sheeting over one layer of 6 mil polyethylene sheeting on walls exposed to the Occupied Area.

.3 Install roof as follows:

.1 Install joists. Size of joists is to be determined by clear span. Consult Provincial Building Code. For clear spans up to 2850 mm use SPF Select 38 x 140 mm wood joist at 400 mm o/c with continuous 38 x 140 mm wood headers and install strapping beneath joists.

.2 At the Contaminated Change Room and where roof is exposed to the Abatement Work Area, install 19 mm plywood or OSB over joists. Caulk and tape joints and install one layer rip-proof polyethylene sheeting over 2 layers of 6 mil polyethylene sheeting.

.3 Where roof is not exposed to the Abatement Work Area, install one layer rip-proof polyethylene sheeting over joists.

.4 Turn 600 mm of polyethylene down the sides over polyethylene on the perimeter walls.

.5 At underside of joists in all rooms, install one layer of polyethylene sheeting.

.6 Minimum interior clear height 2000 mm to underside of joist.

.10 Curtained Doorways

.1 Construct as follows:

.1 Install two flap doors, full width and height of door opening at all doors between chambers, facilities, and Abatement Work Area.

.2 Construct each flap door of two layers of polyethylene sheeting with all edges reinforced with tape. Use wood strapping to securely fasten flap doors to head and alternate jambs.

.3 Install weights attached to bottom edge of each door flap.

.4 Provide direction arrows on flaps to indicate opening.

PART 3 EXECUTION

3.1 Clean Site Preparation

.1 Moving of equipment, tools, supplies, and stored materials that can be performed without disturbing ACM will be performed by others.

.2 Remove visible dust and friable material from all surfaces in the work area including those to be worked on, using HEPA Vacuums or wet wiping using Type 2 (Moderate Risk) Procedures.

.3 Remove surface mounted fixtures specified to be reused or turned over to Owner.

.4 Install Hoarding Walls between Abatement Work Area and Occupied Area.

.5 Install separate Worker and Waste Decontamination facilities.

.6 Install one layer of rip-proof polyethylene sheeting over two layers of 6 mil polyethylene sheeting so as to protect all equipment and finishes in the Abatement Work Area that may be damaged. Items to remain include but are not limited to:

.1 Millwork.

.2 Doors.

.3 Bulkheads.

.4 Plumbing fixtures.

.5 Electrical Equipment.

.7 Seal openings in floor using tape, caulking, polyethylene, etc. Openings in floor are to be sealed independently prior to installation of polyethylene sheeting on floor. Include floors of duct and service shafts.

.8 Seal openings in walls below ceiling level using polyethylene, tape, caulking, etc. including but not limited to windows, doors, vents, diffusers, etc.

.9 Seal openings in ceiling, using polyethylene, tape, caulking, etc. including diffusers, grills, etc.

.10 Install one layer of rip-proof polyethylene sheeting over two layers of 6 mil polyethylene sheeting, on floor surfaces in Abatement Work Area.

.1 Install additional layers of rip-proof polyethylene and/or plywood to protect carpeted floor surfaces.

.2 Extend floor protection a minimum of 300 mm up all vertical surfaces in the Abatement Work Area.

.11 On walls within and forming the perimeter of the Abatement Work Area install two layers of 6 mil polyethylene sheeting.

.1 At junction of floor and wall surface overlap floor polyethylene with wall polyethylene by a minimum of 300 mm at each layer. One layer of wall polyethylene must always overlap the top layer of floor polyethylene.

.12 Establish negative pressure in Abatement Work Areas as follows:

.1 Discharge HEPA filtered negative pressure machines as follows:

.1 To building exterior.

.1 Remove existing glazing where necessary and replace with a 19 mm plywood panel.

.2 Install panel securely on the exterior side of the window frame and make weather-tight with caulking.

.3 For each negative pressure unit, provide a 300 mm diameter, duct opening through panel.

.4 Cover duct opening with wire screen and/or chicken wire or extruded metal screen to prevent insect and animal entry.

.5 Direct discharge away from building access points or fresh air intakes.

.6 Reinstall glazing to match existing upon completion of work.

.2 Use metal reinforced polyethylene discharge ducting in locations where the ducting must be protected from damage or collapse.

.3 Install and make airtight all negative air discharge ducting.

.4 Discharge ducting is not to be longer than required, and to be straight, so that the length of the ducting does not reduce the flow from negative pressure machines.

.5 Install in-line booster fans along the length of discharge ducting wherever site conditions require negative air unit discharge to be directed over distances greater than 12 m (40 ft.). Position booster fans so as to avoid any disruption to operations in Occupied areas.

.2 Leak test in place using DOP method, negative pressure units which discharge directly into Occupied Areas.

.13 Provide one specified ground fault electrical panel for each 300 square metres of Asbestos Work Area. All electrical apparatus including temporary heating equipment shall be supplied from a ground fault system. Ensure safe installation of electrical lines and equipment by skilled tradesmen.

.14 Install temporary lighting in all work areas at levels that will provide for a safe and efficient use of the work area.

.15 Isolate, at panel, and disconnect existing power supply to Abatement Work Area. Power supply to remaining areas of building must not be disrupted during work of this section.

.1 Lock-out/tag-out power at electrical panels.

.2 Mark/tag any items within or passing through the Abatement Work Area that are to remain live including but not limited to cable, conduit, wire, fixtures, equipment panels, etc.

.16 Shut down HVAC systems serving the Abatement Work Area.

.17 Install signage in clearly visible locations and in sufficient numbers to adequately warn of an asbestos dust hazard.

.18 Notify Abatement consultant Milestone Inspection - Clean Site Preparation. Obtain written approval for this Milestone Inspection before proceeding.

3.2 Maintenance Of Contaminated Abatement Work Area

.1 Inspect Abatement Work Area perimeter Hoarding Walls and Upper Perimeter Seals at the beginning and end of each working period and once on each day work does not take place. Inspection must be performed by competent person.

.2 Inspect HEPA filtered negative pressure machines including discharge ducting at the beginning and end of each working period. Inspection must be performed by competent person.

.3 Perform Differential Pressure Monitoring on a frequent basis and record pressure at start and end of shift at a minimum.

.4 Inspect polyethylene sheeting and ensure it is effectively sealed and taped. Repair damage and remedy defects immediately.

.5 Inspect electrical panels and ensure locks and tags are on panels prior to entering the Abatement Work Area.

.6 Maintain Abatement Work Area in tidy condition.

.7 Remove waste and debris frequently.

.8 Remove standing water on polyethylene/floor at the end of every shift.

.9 Turn off water supply to hoses and reduce pressure in hose, prior to leaving the Abatement Work Area at end of shift.

.10 Turn off water supply to showers, at the end of every shift.

.11 Ensure shower pans are pumped out at the end of every use and shift.

3.3 Wet Removal

.1 Do not use compressed air to clean or remove dust or debris.

.2 Remove and dispose of remaining non-asbestos items before, during or after wet removal.

.3 Spray drywall scheduled for removal with Amended Water using airless spray equipment prior to removal. The use of pressure spraying equipment of any type to remove asbestos-containing materials is not permitted.

.4 Remove drywall scheduled for demolition.

.5 All dislodged ACM shall be maintained in wet state until placed in asbestos waste containers for disposal.

.6 As work progresses, and at regular intervals, place waste in asbestos waste containers and remove from the Abatement Work Area.

.7 After completion of gross asbestos removal work, perform the following:

.1 Wet clean surfaces from which ACM has been removed with stiff bristle brushes, vacuums, wet-sponges etc. to remove all visible residue and asbestos-containing materials.

.2 Wet clean surfaces which ACM has fallen on using stiff bristle brushes, vacuums, wet-sponges etc. to remove all visible residue and asbestos-containing materials.

.3 Wet clean other surfaces in the Abatement Work Area, including the decontamination facilities, scaffolding, equipment, polyethylene sheeting on floor and walls surfaces etc., ducts and similar items not covered with polyethylene sheeting.

.4 Remove wash water as contaminated waste.

.5 Remove waste.

.6 Level of cleanliness must be acceptable to Abatement Consultant.

.7 Remove and dispose of the pre-filters from all negative air units as asbestos-contaminated waste.

.8 Notify Abatement Consultant to the need for Milestone Inspection - Visual Clearance.

3.4 Waste and Material Handling

.1 Waste bins must be placed on grade or in receiving.

.2 All bins must be covered and locked when waste transfer is not being performed.

.3 Ensure redundant non-ACM, rubble, debris, etc. which was not cleaned, and which was removed during contaminated work are treated, packaged, transported, and disposed of as asbestos waste.

.4 Clean, wash and apply Post Removal Sealant to metal waste prior to removal from Abatement Work Area.

.1 Recycle metals or dispose of metals as clean waste.

.5 Clean, wash and apply Post Removal Sealant to non-porous materials prior to disposal as clean waste.

.1 Obtain prior written approval from the Abatement Consultant for each individual type of material.

.6 Clean and wash equipment prior to removal from Abatement Work Area if removed prior to completion.

.7 Place all equipment, tools and unused materials that cannot be cleaned in Asbestos Waste Containers.

.8 As work progresses, and at regular intervals, transport the sealed and labelled asbestos waste containers from the Abatement Work Area to waste bin.

.9 Place items in bins according to waste classification. Place asbestos waste, metals, non-asbestos waste, etc. in separate bins.

.10 Removal of waste containers and decontaminated equipment and materials from the Abatement Work Area shall be performed using the Waste and Equipment Decontamination Facility as follows:

.1 Prior to entering the Waste and Equipment Decontamination Facility Container Cleaning Room, the first worker (fully protected inside the Abatement Work Area) shall remove any visible contamination from the

surface of the item or waste container being removed from the Abatement Work Area.

.2 The first worker then carries the item into the Container Cleaning Room and wet sponges the item prior to passing the item through the curtained doorway to a second worker in the Holding Room. (The second worker shall be fully protected with respirator and disposable clothing and may only leave the decontamination facility via the Abatement Work Area.)

.3 The second worker in the Holding Room double bags or wraps and seals the item. Without entering the Transfer Room, the second worker passes the item through the curtained doorway into the Transfer Room.

.4 A third worker enters the Transfer Room from the clean area. (The third worker must never enter the Holding Room.) The third worker removes the item from the Transfer Room and transports it to the disposal bin.

.11 Dispose of debris and other asbestos-contaminated waste that could tear a 6 mil (0.15 mm) polyethylene bag in sealed rigid Asbestos Waste Container.

.12 Transport waste and materials via the predetermined routes and exits. Arrange waste transfer route with Owner. Use a closed, covered cart to transport through Occupied Areas.

.13 Limit transportation of waste and materials through Occupied Areas of the building to Quiet Hours.

.14 Provide workers transporting waste with means to access full personal protective equipment and all tools required to properly clean up spilled ACM in the case of a rupture of an Asbestos Waste Container.

.15 Bin loading area and waste routes shall be kept clean at all times. Use Type 2 asbestos abatement procedures if appropriate or requested by Owner's Representative.

.16 Pick-up and drop off of garbage bin shall be at pre-approved times and must not interfere with the Owners operations.

.17 Transport asbestos contaminated waste to landfill licensed by Manitoba Conservation and Climate.

.18 Co-operate with inspectors from the provincial regulator and immediately carry out instructions for remedial work at dump to maintain environment, at no additional cost to the Owner.

3.5 Application Of Post Removal Sealant

.1 Wet Removal

.1 Obtain Abatement Consultant's written permission to proceed.

.2 Apply one coat of Post Removal Sealant with an airless sprayer, in accordance with Manufacturer’s Instructions, to cover all surfaces on all items in the Abatement Work Area, including but not limited to polyethylene, ACM substrate, structural steel, and surfaces scheduled for demolition.

.1 Do not apply post removal sealant to materials that will be damaged by its application.

.3 Notify Abatement Consultant to the need for Milestone Inspection – Clearance Sampling.

3.6 Air Clearance Monitoring

.1 Site must be dry prior to Air Clearance Monitoring.

.2 The number of Air Clearance Monitoring samples will be as follows:

.1 One sample for every 250 square metres of enclosure volume, minimum of one.

.3 Restrict access to Abatement Work Area and operate negative air units for a 12-hour period prior to Milestone Inspection – Clearance Sampling.

.4 The HEPA filtered negative pressure machines shall be in operation during clearance air monitoring.

.5 PCM samples will be collected as per Air Monitoring Section.

3.7 Abatement Work Area Dismantling

.1 Maintain hoardings, decontamination facilities and negative air unit(s) fully functional during teardown and removal of asbestos contaminated polyethylene, tape, etc.

.2 Use Type 2 (Moderate Risk) worker precautions during dismantling.

.3 Operate negative air units during dismantling.

.4 Phase the removal of polyethylene, tape, polyurethane foam, caulking and enclosures from the Asbestos Work Area so as to maintain perimeter isolation as long as possible.

.5 Polyethylene, tape, cleaning material, etc. to be treated as asbestos waste.

.6 Wash remaining equipment and tools used in contaminated Abatement Work Area to remove all asbestos contamination, or place in Asbestos Waste Containers prior to being removed from Abatement Work Area.

.7 Clean Abatement Work Area, Equipment and Access area, washing/Showering Room.

.8 Remove upper seals, and seals over tops of walls, on deck, at columns, etc. within the Abatement Work Area.

.9 Remove top layer of polyethylene sheeting from surfaces protected by two or more layers of polyethylene sheeting. Remove outer layer as follows:

.1 Remove asbestos contaminated Polyethylene by carefully rolling away from walls to centre of Abatement Work Area.

.2 Cut the lower layer of polyethylene sheeting to expose the baseboards, windowsills, cabinets, shelves, and other horizontal surfaces that may be contaminated by fallen ACM.

.3 Remove visible fibres or residue found during removal of polyethylene using a HEPA vacuum.

.4 Remove polyethylene protection and hoarding walls where hoarding walls separate occupied areas from work area. Hoarding walls to remain are identified on asbestos demolition drawings.

.10 Remove top layer of polyethylene on walls, finishes, and equipment.

.11 Remove remaining polyethylene sheeting.

.12 Remove water hoses and shut off at source.

.13 Remove Signs, Hoarding Walls, Decontamination Facilities.

.14 Seal vacuum hoses and fittings, flexible ductwork and all tools used in contaminated work site in 6 mil polyethylene bags prior to removal from Work Area.

.15 Remove temporary lights.

.16 Remove negative air unit prefilters. Dispose of as asbestos contaminated waste.

.17 Remove HEPA filtered negative pressure machines and discharge ducting.

.18 Immediately upon shutting down negative air units, seal air inlet grill and exhaust vent with polyethylene and tape.

3.8 Re-Establishment of Items

.1 Upon completion of work:

.1 Remove and disconnect Ground fault Panel, tags and locks from electrical panels and re-energize equipment and items.

.2 Remove negative air discharge panel and reinstall glazing to match existing.

.3 Clean, mop and vacuum Abatement Work Area and area beneath Decontamination Facilities.

.4 Enable building air handling systems.

END OF SECTION

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PART 1 GENERAL

1.1 General and Related Work

.1 Read this Section in conjunction with all drawings and all other Sections so as to comply with the requirements of Division 1 and the General Conditions of the Contract.

.2 Requirements specified elsewhere:

.1 Section 02 81 00 Hazardous Materials – General Provisions

1.2 Outline of Work

.1 Refer to Section 02 81 00 Hazardous Materials – General Provisions for the Outline of Work.

.2 Isolate the Abatement Work Area from adjoining spaces through the installation of temporary barriers and partitions as specified herein.

.3 The intent of this Section is to provide safe work practices and procedures to govern the handling, removal, clean-up, and disposal of asbestos-containing materials following Glove Bag procedures, and Pinchin and Owner specific requirements.

.4 De-activate steam and condensate, and hot water heating pipe systems prior to work.

1.3 Instruction and Training

.1 Provide instruction and training to all workers including the following:

.1 Hazards of asbestos.

.2 Use, care, and disposal of protective equipment (including but not limited to respirators and filters) and clothing that would be used and worn during abatement work, including:

.1 Limitations of equipment.

.2 Inspection and maintenance of equipment.

.3 Proper fitting of equipment.

.4 Disinfecting and cleaning of equipment.

.3 Personal hygiene to be observed when performing the work.

.4 The measures and procedures prescribed by this section and decontamination of the worker.

.5 Instruction and training must be provided by a competent person.

1.4 Personal Protection

.1 Protect all personnel at all times when possibility of disturbance of ACM exists.

.2 Provide the following minimum respiratory protection to all personnel:

.1 Non-powered half-face respirators with P100 high efficiency (HEPA) cartridge filters.

.3 Provide protective clothing, to all personnel entering the Abatement Work Area.

.4 Wear hard hats, safety shoes and other personal protective equipment required by applicable construction safety regulations.

1.5 Inspections

.1 Refer to Part 1.12 Inspections in Section 02 81 00 – General Provisions.

.2 The following Milestone Inspections are to be scheduled:

.1 Milestone Inspection - Visual Clearance

.2 Milestone Inspection – Clearance Sampling

PART 2 PRODUCTS AND FACILITIES

2.1 Materials and Equipment

.1 Refer to Section 02 81 00.

.2 Glove Bag: Prefabricated bag which provides a completely sealed envelope surrounding a given section of piping to permit the removal of asbestos-containing insulation from within the bag while maintaining the integrity of the bag and preventing the spread of airborne asbestos fibres. The glove bag shall be equipped with,

.1 sleeves and gloves that are permanently sealed to the body of the bag to allow the worker to access and deal with the insulation and maintain a sealed enclosure throughout the work period,

.2 valves or openings to allow insertion of a vacuum hose and the nozzle of a water sprayer while maintaining the seal to the pipe, duct, or similar structure,

.3 a tool pouch with a drain,

.4 a seamless bottom and a means of sealing off the lower portion of the bag, and

.3 Securing Straps: For some types of Glove Bag, reusable nylon straps at least 25mm wide with metal tightening buckle for sealing ends of bags around pipe and/or insulation.

PART 3 EXECUTION

3.1 Site Preparation - General

.1 Moving of equipment, tools, supplies, and stored materials that can be performed without disturbing ACM will be performed by others.

.1 Shut down HVAC systems serving the Abatement Work Area.

.1 Install polyethylene sheeting over openings in ducts and at diffusers and seal.

.2 HVAC to remaining areas of building must not be disrupted during work of this section.

.3 System shall remain inoperative until completion of work unless ducts can be effectively capped.

.4 Perform work at scheduled times after shutting down HVAC systems affecting the Abatement Work Area.

.2 Install caution tape around work area where existing walls are not present.

.3 Install Signage in clearly visible locations and in sufficient numbers to adequately warn of an asbestos dust hazard.

.4 Remove visible dust and friable material from all surfaces in the work area including those to be worked on, using HEPA Vacuums or wet wiping.

.5 Cover walls, floors, finishes, millwork, equipment, and furnishings below the pipe to be worked on in the Abatement Work Area with polyethylene sheets before disturbing ACM. Drop sheets shall extend a minimum of 1,800 mm from pipe.

.6 Use existing lighting or install temporary lighting to a level that will provide for safe and efficient use of work area - minimum 550 LUX.

.7 Provide Amended Water for wetting ACM, in garden sprayers. Provide one garden sprayer for each worker.

.8 Do not used compressed air to clean or remove and dust or debris when completing work of this section.

.9 Place HEPA Vacuum in Abatement Work Area for each worker.

.10 Place required tools to complete the abatement within the Abatement Work Area.

.11 Install Signage in clearly visible locations and in sufficient numbers to adequately warn of an asbestos dust hazard.

.12 Do not commence contaminated work until authorized by the Abatement Consultant.

3.2 Maintenance of Abatement Work Area

.1 Maintain Abatement Work Area in tidy condition.

3.3 Glove Bag Removal

.1 Do not use Glove Bags on hot pipes that may damage Glove Bag. Refer to manufacturer's limitations.

.2 Prior to use of Glove Bag on damaged or unjacketed insulation:

.1 Spray any areas of damaged insulation jacketing with mist of Amended Water.

.2 Tape over damaged insulation to provide temporary repair.

.3 Mist areas of insulation with no jacketing and wrap with polyethylene sheeting and seal with tape.

.3 Place any tools necessary to remove insulation in tool pouch built into Glove Bag.

.4 Inspect the Glove Bag for damage and defects immediately before it is attached to the pipe or duct.

.1 If damage or defects are observed, dispose of Glove Bag.

.5 Install Glove Bag as per manufacturer's instructions.

.6 Remove insulation from pipe as per manufacturer's directions.

.1 Volume and weight of insulation must not exceed capacity of the Glove Bag or supports.

.2 Arrange insulation in the Glove Bag to maximize use of the Glove Bag.

.7 Only single use glove bags are permitted.

.8 At regular intervals during its use, if damage or defects are observed during the use of the Glove Bag, which cannot be readily repaired with tape and not affect the integrity or strength of the glove bag.

.1 Discontinue use of Glove Bag.

.2 Wash inner surface of Glove Bag.

.3 Wet insulation.

.4 Pull an Asbestos Waste Container over Glove Bag before removing from pipe.

.5 Remove Glove Bag and Asbestos Waste Container, seal with tape.

.6 Place in a second Asbestos Waste Container and seal with tape.

.7 Clean immediate area with a HEPA Vacuum prior to resuming work.

.9 Glove bags may not be moved along pipe for use on adjacent sections of insulation:

.10 To remove bag after completion of insulation removal operation:

.1 Wash inner surface of Glove Bag.

.2 Wash and place all tools in one hand (glove), pull hand out inverted, twist to create a separate pouch, tape inverted hand at two separate locations 25 mm apart to seal pouch.

.1 Remove inverted hand and tools by cutting between the two tape seals.

.2 Place inverted hand pouch and tools into the next clean Glove Bag to be used or into a water bucket, open pouch underwater and clean tools.

.3 Wet surface of insulation in lower section of bag and any exposed end of asbestos insulation remaining on pipe with Amended Water.

.4 Insert nozzle of HEPA filtered vacuum cleaner into bag through valve and evacuate air from bag.

.5 Seal valve cover on valve Glove Bags.

.6 Seal closure strip if equipped with one. Twist bag at tapered point and secure with tape.

.7 Pull an Asbestos Waste Container over Glove Bag before removing from pipe.

.1 Cut upper portion of single-use Glove Bag.

.2 Seal Asbestos Waste Container with tape.

.8 Ensure pipe is clean of all residues after removal of Glove Bag. If necessary, after removal of each section of asbestos, vacuum all surfaces of pipe, using HEPA vacuum or wipe with wet cloth.

.11 Seal all surfaces of freshly exposed pipe with Post Removal Sealer.

3.4 Clean-Up and Dismantling

.1 Remove equipment and tools.

.2 Remove temporary lighting if used.

.3 Remove polyethylene seals from HVAC systems.

.4 Place polyethylene sheeting, drop sheets, seals, tape, clothing and other contaminated waste in asbestos waste containers, wet wipe, and place in second asbestos waste container.

.5 Clean Abatement Work Area with HEPA vacuums or wet wiping/mopping.

.6 Seal openings in HEPA vacuums.

.7 Schedule and obtain written approval of Milestone Inspection – Clearance Sampling before proceeding with the removal of all barricades, etc.

.8 Remove barricades, fencing, caution tape, signs, etc.

3.5 Waste and Material Handling

.1 Refer to Section 02 81 00.

3.6 Re-Establishment of Items

.1 Upon completion of work:

.1 Remove tags and locks from electrical panels and re-energize equipment and items.

.2 Enable building air handling systems.

.3 Clean and vacuum Abatement Work Area.

END OF SECTION

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PART 1 GENERAL

.1 Read this Section in conjunction with all drawings and all other Sections so as to comply with the requirements of Division 1 and the General Conditions of the Contract.

.2 Requirements specified elsewhere:

.1 Section 02 81 00 Hazardous Materials – General Provisions

1.2 Outline of Work

.1 Refer to Section 02 81 00 Hazardous Materials – General Provisions for the Outline of Work.

.2 Isolate the Lead Work Area from adjoining spaces through the installation of temporary barriers and partitions, hoardings, seals, and enclosures at the perimeter of each phase or work area as specified herein.

.3 The intent of this Section is to provide safe work practices and procedures to govern the handling, removal, clean-up, and disposal of lead-containing materials following Type 1 (Low Risk) procedures, and Pinchin and Owner specific requirements.

.4 Comply with requirements of this Section when performing following Work:

.1 Removal of lead-containing paints, using non-powered hand tools.

1.3 Instruction and Training

.1 Provide instruction and training to all workers including the following:

.1 Hazards of lead.

.2 Use, care, and disposal of protective equipment (including but not limited to respirators and filters) and clothing that would be used and worn during abatement work, including:

.1 Limitations of equipment.

.2 Inspection and maintenance of equipment.

.3 Proper fitting of equipment.

.4 Disinfecting and cleaning of equipment.

.3 Personal hygiene to be observed when performing the work.

.4 The measures and procedures prescribed by this section including decontamination of the worker.

.5 Instruction and training must be provided by a competent person.

1.4 Personal Protection

.1 Provide, if requested by personnel, non-powered half-face respirators with high efficiency (HEPA) cartridge filters. Respirators are not mandatory for Type 1 (Low Risk) work.

.2 Provide protective clothing, when requested by personnel, entering the Abatement Work Area, including:

.1 Disposable protective clothing that does not readily retain or permit skin contamination, consisting of full body covering including head covering with snug fitting cuffs at wrists, ankles, and neck.

.3 Provide protective clothing, to all personnel entering the Abatement Work Area, including:

.1 Dust impermeable gloves appropriate for the work being completed.

.4 Provide facilities for washing of hands and face to the personnel which shall be used by every worker when leaving the abatement work area. Lead-specific soaps and hygiene indicators are recommended to be provided for hand-wash stations.

1.5 Site Reviews

.1 Refer to Part 1.12 Site Reviews in Section 02 81 00 – General Provisions.

.2 The following Milestone Inspections are to be scheduled:

.1 Milestone Reviews - Visual Clearance

PART 2 PRODUCTS AND FACILITIES

.1 Refer to Section 02 81 00.

PART 3 EXECUTION

3.1 Site Preparation - General

.1 Provide washing facilities consisting of a wash basin, clean water, soap, and towels.

.1 Workers are to use washing facilities each time leaving the Abatement Work Area.

.2 Stored or non-fixed items, including but not limited to equipment, furniture, waste etc., shall be removed from the Abatement Work Area prior to abatement work.

.3 Isolate, at panel, and disconnect existing power supply to Abatement Work Area. Power supply to remaining areas of building must not be disrupted during work of this section.

.1 Lock-out/tag-out power at electrical panels.

.2 Mark/tag any items within or passing through the Abatement Work Area that are to remain live including but not limited to cable, conduit, wire, fixtures, equipment panels, etc.

.4 Shut down HVAC systems serving the Abatement Work Area.

.1 Install polyethylene sheeting over openings in ducts, diffusers, and seal.

.2 HVAC to remaining areas of building must not be disrupted during work of this section.

.3 System shall remain inoperative until completion of work unless ducts can be effectively capped.

.4 Perform work at scheduled times after shutting down HVAC systems affecting the Abatement Work Area.

.5 Remove visible dust from all surfaces in the work area including those to be worked on, using HEPA Vacuums or wet wiping.

.6 Provide amended water for wetting materials, and adequate method of wetting (garden sprayers, airless sprayers, etc.).

.7 Do not use compressed air to clean or remove dust or debris.

.8 Frequently and at regular intervals during the work, clean up dust and waste using HEPA vacuums and/or wet sweeping or mopping.

.9 Frequently and at regular intervals, place all waste in waste containers.

.10 Immediately upon completion of work, clean area with HEPA vacuum and/or wet sweeping or mopping.

3.2 Site Preparation – No Enclosure Required

.1 Isolate Abatement Work Area with barrier tape.

.2 Protect floor surfaces covered from wall to wall with polyethylene sheets.

.3 Do not commence contaminated work until authorized by the Abatement Consultant.

3.3 Maintenance of Abatement Work Area

.1 Maintain Abatement Work Area in tidy condition.

.2 Remove waste and debris frequently.

.3 Remove standing water on polyethylene/floor at the end of every shift.

3.4 Lead-Containing Paint Abatement

.1 Removal methods minimizing dust generation should be used wherever possible.

.1 Wet methods are to be used to reduce dust generation.

.2 Wetting agents should be used where possible.

.3 Wet method is not used if it creates a hazard or cause damage to equipment or to project.

.2 Provide drop sheets below all lead operations that may produce dust, chips or debris containing lead.

.3 Wastewater from cleaning or removal operations must be contained, for treatment or disposal.

.4 Remove loose flaking lead-based paint where required to prepare for painting.

.5 After completion removal, wet sponge surface from which lead based paint has been removed to remove visible material. During this work keep surfaces wet.

.6 After wet sponging, wet clean entire work area, and equipment used in process.

.1 Compressed air or dry sweeping is not used to clean up lead-containing dust or waste.

.2 Ensure all waste is cleaned and packaged.

.7 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate working area to staging area. Clean external surfaces thoroughly again by wet sponging. Wash containers thoroughly pending removal to outside.

3.5 Waste Management and Disposal

.1 Per Section 02 81 00.

3.6 Abatement Work Area Dismantling

.1 Do not commence site dismantlement until authorized by the Abatement Consultant.

.2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible lead containing particles observed during cleanup, immediately, using HEPA vacuum.

.3 Place polyethylene sheets, tape, cleaning material, clothing, and contaminated waste in plastic bags and sealed labelled waste containers for transport.

.4 Conduct final check to ensure no dust or debris remains on surfaces as result of dismantling operations.

END OF SECTION

PART 1 GENERAL

1.1 General and Related Work

.1 Read this Section in conjunction with all drawings and all other Sections so as to comply with the requirements of Division 1 and the General Conditions of the Contract.

.2 Requirements specified elsewhere:

.1 Section 02 81 00 Hazardous Materials – General Provisions

1.2 Outline of Work

.1 Refer to Section 02 81 00 Hazardous Materials – General Provisions for the Outline of Work.

.2 Install Hoarding Walls between Abatement Work Area boundaries.

.1 Install Type A Hoarding Walls between the Abatement Work Area and unoccupied and occupied areas.

.3 Using Type 3 (High Risk) procedures of this section, remove and dispose of the following:

.1 Loose fill material between floors.

1.3 Personal Protection

.1 Protect all personnel at all times when possibility of disturbance of hazardous materials exists.

.2 Provide the following respiratory protection to all personnel:

.1 Full Face Air Purifying Respirators with P100 high efficiency (HEPA) cartridge filters during projects when performing abatement hazardous materials or contaminated materials specified in this section.

.2 Non-powered half-face respirators with P100 high efficiency (HEPA) cartridge filters for dismantling of Type 3 [High Risk] enclosures, using Type 2 [Moderate Risk] Procedures.

.3 Provide protective clothing, to all personnel entering the Abatement Work Area.

.4 Wear hard hats, safety shoes and other personal protective equipment required by applicable construction safety regulations.

1.4 Differential Pressure Monitoring

.1 Install differential pressure monitor at a location chosen by the Abatement Consultant.

.2 Co-operate with the Abatement Consultant in collection of pressure monitoring data.

.3 Maintain specified differential pressure at monitoring location. Negative air pressure is to be -0.02 inches of water, relative to the area outside the enclosed area.

1.5 Site Reviews

.1 Refer to Part 1.12 Site Reviews in Section 02 81 00 – General Provisions.

.2 The following Milestone Site Reviews are to be scheduled:

.1 Milestone Review - Clean Site Preparation

.2 Milestone Review – Bulk Removal Review

.3 Milestone Review - Visual Clearance

PART 2 PRODUCTS AND FACILITIES

2.1 Materials and Equipment

.1 Refer to Section 02 81 00.

2.2 Hoarding Walls

.1 Type A Hoarding Wall: 38 mm x 89 mm wood or metal studs at 400 mm o/c with continuous sill and top plate, covered with one layer of rip-proof polyethylene sheeting on each side of wall.

2.3 Decontamination Facilities

.1 Workers' Decontamination Facility: A decontamination facility comprised of three linked rooms, Contaminated Change Room, a Shower Room, and a Clean Change Room.

.1 Rooms, Occupied Areas and Abatement Work Areas, shall be separated by curtained doorways at each door.

.2 Contaminated Change Room: Room between Shower Room and Abatement Work Area.

.1 Locate on contaminated side of Shower Room.

.2 Install hazardous waste container for contaminated protective clothing.

.3 Install storage facilities for any personal protective equipment to be reused in Abatement Work Area including boots, hard hats, etc., but excluding respirators.

.4 Install hooks and shelves as required for personal protective equipment.

.5 Minimum size of generally 2 m x 2 m. Increase size accordingly to accommodate number of workers.

.3 Shower Room: Room between Clean Change Room and Contaminated Change Room.

.1 Install one walk through shower unit for every six workers.

.2 Install constant supply of hot and cold water, controllable at each shower. Water supply must be sufficient to provide water at a minimum temperature of 40 degrees Celsius (maximum 50 degrees) in a volume required for all workers to properly decontaminate.

.1 Install individual hot and cold shut-off valves on water supply located on clean side of Shower Room. Connect shower to these valves.

.2 Install individual controls inside the shower to regulate water flow and temperature.

.3 Install rigid piping or Shower Hose with watertight connections for supply and drains.

.4 Install a sealed drip pan under and around the showers, 150 mm deep.

.5 Install sump pumps, sufficient for volume of waste shower water from showers and drip pan. Direct waste shower water to sanitary drains.

.6 Install ground fault protected power switch on clean side of shower for sump pumps or timed for shut off.

.7 Provide adequate quantity of soap, shampoo, clean towels

.8 Install a Hazardous Waste Container for disposal of used respirator filters, on the contaminated side of the Shower Room.

.4 Clean Change Room: A room between the Shower Room and Occupied Areas.

.1 Install hooks and shelves on clean side of shower in clean Change Room for storage of respirators.

.2 Install lockers or hangers for workers' street clothes and personal belongings.

.3 Provide ground fault protected power supply to hot water tanks, sump pump, battery chargers.

.4 Install a fire extinguisher, mount to wall.

.5 Minimum size of generally 2m x 2m. Increase size accordingly to accommodate number of workers.

.5 Waste and Equipment Decontamination Facility: Waste and Equipment Decontamination Facility comprised of three linked rooms: a Container Cleaning Room, a Holding Room and a Transfer Room.

.1 Purpose of Waste and Equipment Decontamination Facility is to provide a means to decontaminate hazardous waste containers, vacuums, and other tools and equipment and materials required in the Abatement Work Area.

.2 Rooms, Occupied Areas and Abatement Work Areas, shall be separated by curtained doorways at each door.

.6 Container Cleaning Room: Room between Abatement Work Area and Holding Room of sufficient size to allow proper washing of equipment and waste containers or double bagging of hazardous waste. All wash water shall be treated as hazardous contaminated waste.

.7 Holding Room: Room between Container Cleaning Room and Transfer Room, of sufficient size to accommodate at least two hazardous waste containers and two workers double bagging waste, or for largest item of equipment used.

.1 Install a fire extinguisher mounted to wall.

.8 Transfer Room: Room between Holding Room and Occupied Area, acting as an air lock for the transfer of waste.

.9 Construction of Decontamination Facilities.

.1 Install floor protection as follows:

.1 Install one layer of rip-proof polyethylene sheeting over two layers of 6 mil polyethylene sheeting beneath entire decontamination facility.

.2 Turn 600 mm of polyethylene up the sides of the decontamination facility and overlap with the polyethylene sheeting covering the walls.

.3 Install plywood with taped and caulked joints between layers of 6 mil polyethylene where required to protect surfaces from water damage (e.g. carpet).

.2 Install walls as follows:

.1 Around all rooms, between all rooms, at entrance to Abatement Work Area and at entrance to Occupied Area.

.2 Install 38 x 89 mm wood framing at 610 mm o/c with continuous top and sill plates.

.3 Install one layer rip-proof polyethylene sheeting on interior walls of Decontamination Facility.

.4 Install one layer rip-proof polyethylene sheeting both sides on interior dividing walls of Decontamination Facility.

.5 Install one layer rip-proof polyethylene sheeting over one layer of 6 mil polyethylene sheeting on walls exposed to the Abatement Work Area.

.6 Install one layer rip-proof polyethylene sheeting over one layer of 6 mil polyethylene sheeting on walls exposed to the Occupied Area.

.3 Install roof as follows:

.1 Install joists. Size of joists is to be determined by clear span. Consult Provincial Building Code. For clear spans up to 2850 mm use SPF Select 38 x 140 mm wood joist at 400 mm o/c with continuous 38 x 140 mm wood headers and install strapping beneath joists.

.2 At the Contaminated Change Room and where roof is exposed to the Abatement Work Area, install 19 mm plywood or OSB over joists. Caulk and tape joints and install one layer rip-proof polyethylene sheeting over 2 layers of 6 mil polyethylene sheeting.

.3 Where roof is not exposed to the Abatement Work Area, install one layer rip-proof polyethylene sheeting over joists.

.4 Turn 600 mm of polyethylene down the sides over polyethylene on the perimeter walls.

.5 At underside of joists in all rooms, install one layer of polyethylene sheeting.

.6 Minimum interior clear height 2000 mm to underside of joist.

.10 Curtained Doorways

.1 Construct as follows:

.1 Install two flap doors, full width and height of door opening at all doors between chambers, facilities and Abatement Work Area.

.2 Construct each flap door of two layers of polyethylene sheeting with all edges reinforced with tape. Use wood strapping to securely fasten flap doors to head and alternate jambs.

.3 Install weights attached to bottom edge of each door flap.

.4 Provide direction arrows on flaps to indicate opening.

PART 3 EXECUTION

3.1 Clean Site Preparation

.1 Moving of equipment, tools, supplies, and stored materials that can be performed without disturbing ACM will be performed by others.

.2 Install Hoarding Walls between Abatement Work Area and Occupied Area.

.3 Install separate Worker and Waste Decontamination facilites.

.4 Install one layer of rip-proof polyethylene sheeting over two layers of 6 mil polyethylene sheeting so as to protect all equipment and finishes in the Abatement Work Area that may be damaged. Items to remain include but are not limited to:

.1 Millwork.

.2 Doors.

.3 Bulkheads.

.4 Toilet Partitions.

.5 Plumbing fixtures.

.6 Electrical Equipment.

.7 Mechanical Equipment.

.8 Kitchen Equipment.

.5 Seal openings (excepting electrical trenches) in floor using tape, caulking, polyethylene, etc.

.6 Seal openings in walls below ceiling level using polyethylene, tape, caulking, etc. including but not limited to windows, doors, vents, diffusers, etc.

.7 Seal openings in ceiling, using polyethylene, tape, caulking, etc. including diffusers, grills, etc.

.8 On walls within and forming the perimeter of the Abatement Work Area install two layers of 6 mil polyethylene sheeting.

.9 Establish negative pressure in Abatement Work Areas as follows:

.1 Discharge HEPA filtered negative pressure machines as follows:

.1 To building exterior.

.1 Remove existing glazing where necessary and replace with a 19 mm plywood panel.

.2 Install panel securely on the exterior side of the window frame and make weather-tight with caulking.

.3 For each negative pressure unit, provide a 300 mm diameter, duct opening through panel.

.4 Cover duct opening with wire screen and/or chicken wire or extruded metal screen to prevent insect and animal entry.

.5 Direct discharge away from building access points or fresh air intakes.

.6 Reinstall glazing to match existing upon completion of work.

.2 Use metal reinforced polyethylene discharge ducting in locations where the ducting must be protected from damage or collapse.

.3 Install and make airtight all negative air discharge ducting.

.4 Discharge ducting is not to be longer than required, and to be straight, so that the length of the ducting does not reduce the flow from negative pressure machines.

.5 Install in-line booster fans along the length of discharge ducting wherever site conditions require negative air unit discharge to be directed over distances greater than 12 m (40 ft.). Position booster fans so as to avoid any disruption to operations in Occupied areas.

.10 Provide one specified ground fault electrical panel for each 300 square metres of Abatement Work Area. All electrical apparatus including temporary heating equipment shall be supplied from a ground fault system. Ensure safe installation of electrical lines and equipment by skilled tradesmen.

.11 Install temporary lighting in all work areas at levels that will provide for a safe and efficient use of the work area.

.12 Isolate, at panel, and disconnect existing power supply to Abatement Work Area. Power supply to remaining areas of building must not be disrupted during work of this section.

.1 Lock-out/tag-out power at electrical panels.

.2 Mark/tag any items within or passing through the Abatement Work Area that are to remain live including but not limited to cable, conduit, wire, fixtures, equipment panels, etc.

.13 Shut down HVAC systems serving the Abatement Work Area.

.14 Perform clean demolition of non-hazardous materials as specified.

.15 Install signage in clearly visible locations and in sufficient numbers to adequately warn of a hazardous dust hazard.

.16 Notify Abatement consultant Milestone Inspection - Clean Site Preparation. Obtain written approval for this Milestone Inspection before proceeding.

3.2 Maintenance Of Contaminated Abatement Work Area

.1 Inspect Abatement Work Area perimeter Hoarding Walls at the beginning and end of each working period and once on each day work does not take place. Inspection must be performed by competent person.

.2 Inspect HEPA filtered negative pressure machines including discharge ducting at the beginning and end of each working period. Inspection must be performed by competent person.

.3 Perform Differential Pressure Monitoring on a frequent basis and record pressure at start and end of shift at a minimum.

.4 Inspect polyethylene sheeting and ensure it is effectively sealed and taped. Repair damage and remedy defects immediately.

.5 Inspect electrical panels and ensure locks and tags are on panels prior to entering the Abatement Work Area.

.6 Maintain Abatement Work Area in tidy condition.

.7 Remove waste and debris frequently.

.8 Remove standing water on polyethylene/floor at the end of every shift.

.9 Turn off water supply to hoses and reduce pressure in hose, prior to leaving the Abatement Work Area at end of shift.

.10 Turn off water supply to showers, at the end of every shift.

.11 Ensure shower pans are pumped out at the end of every use and shift.

3.3 Wet Removal

.1 Do not use compressed air to clean or remove dust or debris.

.2 Remove and dispose of remaining non-hazardous items before, during or after wet removal.

.3 Remove top layer of flooring to expose loose fill material.

.4 Spray loose fill material with Amended Water using airless spray equipment prior to removal. Saturate material to prevent release of silica and metals during removal.

.5 Remove fill material and clean substrate.

.6 Remove obstructions as required to remove the fill material.

.7 All dislodged ACM shall be maintained in wet state until placed in waste containers for disposal.

.8 As work progresses, and at regular intervals, place waste in waste containers and remove from the Abatement Work Area.

.9 After completion of removal work, perform the following:

.1 Wet clean surfaces from which fill material has been removed with stiff bristle brushes, vacuums, wet-sponges etc. to remove all visible residue.

.2 Wet clean surfaces which fill material has fallen on using stiff bristle brushes, vacuums, wet-sponges etc. to remove all visible residue.

.3 Wet clean other surfaces in the Abatement Work Area, including the decontamination facilities, equipment, polyethylene sheeting on wall surfaces etc., ducts and similar items not covered with polyethylene sheeting.

.4 Remove wash water as contaminated waste.

.5 Remove waste.

.6 Level of cleanliness must be acceptable to Abatement Consultant.

.7 Remove and dispose of the pre-filters from all negative air units as hazardous-contaminated waste.

.10 Notify Abatement Consultant to the need for Milestone Inspection - Visual Clearance.

3.4 Waste and Material Handling

.1 Waste bins must be placed on grade or in receiving.

.2 All bins must be covered and locked when waste transfer is not being performed.

.3 Ensure redundant non-hazardous, rubble, debris, etc. which was not cleaned and which was removed during contaminated work are treated, packaged, transported and disposed of as hazardouss waste.

.4 Clean, wash and apply Post Removal Sealant to metal waste prior to removal from Abatement Work Area.

.1 Recycle metals or dispose of metals as clean waste.

.5 Clean, wash and apply Post Removal Sealant to non-porous materials prior to disposal as clean waste.

.1 Obtain prior written approval from the Abatement Consultant for each individual type of material.

.6 Clean and wash equipment prior to removal from Abatement Work Area if removed prior to completion.

.7 Place all equipment, tools and unused materials that cannot be cleaned in Hazardous Waste Containers.

.8 As work progresses, and at regular intervals, transport the sealed and labelled hazardous waste containers from the Abatement Work Area to waste bin.

.9 Place items in bins according to waste classification. Place hazardous waste, metals, non-hazardous waste, etc. in separate bins.

.10 Removal of waste containers and decontaminated equipment and materials from the Abatement Work Area shall be performed using the Waste and Equipment Decontamination Facility as follows:

.1 Prior to entering the Waste and Equipment Decontamination Facility Container Cleaning Room, the first worker (fully protected inside the Abatement Work Area) shall remove any visible contamination from the surface of the item or waste container being removed from the Abatement Work Area.

.2 The first worker then carries the item into the Container Cleaning Room and wet sponges the item prior to passing the item through the curtained doorway to a second worker in the Holding Room. (The second worker shall be fully protected with respirator and disposable clothing and may only leave the decontamination facility via the Abatement Work Area.)

.3 The second worker in the Holding Room double bags or wraps and seals the item. Without entering the Transfer Room, the second worker passes the item through the curtained doorway into the Transfer Room.

.4 A third worker enters the Transfer Room from the clean area. (The third worker must never enter the Holding Room.) The third worker removes the item from the Transfer Room and transports it to the disposal bin.

.11 Dispose of debris, and other hazardous-contaminated waste that could tear a 6 mil (0.15 mm) polyethylene bag in sealed rigid Hazardous Waste Container.

.12 Transport waste and materials via the predetermined routes and exits. Arrange waste transfer route with Owner. Use a closed, covered cart to transport through Occupied Areas.

.13 Limit transportation of waste and materials through Occupied Areas of the building to Quiet Hours.

.14 Provide workers transporting waste with means to access full personal protective equipment and all tools required to properly clean up spilled hazardous materials in the case of a rupture of a Hazardous Waste Container.

.15 Bin loading area and waste routes shall be kept clean at all times. Use Type 2 abatement procedures if appropriate or requested by Owner's Representative.

.16 Pick-up and drop off of garbage bin shall be at pre-approved times, and must not interfere with the Owners operations.

.17 Transport contaminated waste to landfill licensed by Manitoba Conservation and Climate.

.18 Co-operate with inspectors from the provincial regulator and immediately carry out instructions for remedial work at dump to maintain environment, at no additional cost to the Owner.

3.5 Application Of Post Removal Sealant

.1 Wet Removal

.1 Obtain Abatement Consultant's written permission to proceed.

.2 Apply one coat of Post Removal Sealant with an airless sprayer, in accordance with Manufacturer’s Instructions, to cover all surfaces on all items in the Abatement Work Area, including but not limited to polyethylene, ACM substrate, structural steel, and surfaces scheduled for demolition.

.1 Do not apply post removal sealant to materials that will be damaged by its application.

.3 Notify Abatement Consultant to the need for Milestone Inspection – Clearance Sampling.

3.6 Abatement Work Area Dismantling

.1 Maintain hoardings, decontamination facilities and negative air unit(s) fully functional during teardown and removal of contaminated polyethylene, tape, etc.

.2 Use Type 2 (Moderate Risk) worker precautions during dismantling.

.3 Operate negative air units during dismantling.

.4 Phase the removal of polyethylene, tape, polyurethane foam, caulking and enclosures from the Abatement Work Area so as to maintain perimeter isolation as long as possible.

.5 Polyethylene, tape, cleaning material, etc. to be treated as hazardous waste.

.6 Wash remaining equipment and tools used in contaminated Abatement Work Area to remove all contamination, or place in Hazardous Waste Containers prior to being removed from Abatement Work Area.

.7 Clean Abatement Work Area, Equipment and Access area, washing/Showering Room.

.8 Remove upper seals, and seals over tops of walls, on deck, at columns, etc. within the Abatement Work Area.

.9 Remove top layer of polyethylene sheeting from surfaces protected by two or more layers of polyethylene sheeting. Remove outer layer as follows:

.1 Remove contaminated Polyethylene by carefully rolling away from walls to centre of Abatement Work Area.

.2 Cut the lower layer of polyethylene sheeting to expose the baseboards, window sills, cabinets, shelves and other horizontal surfaces that may be contaminated by fallen ACM.

.3 Remove visible residue found during removal of polyethylene using a HEPA vacuum.

.4 Remove polyethylene protection and hoarding walls where hoarding walls separate occupied areas from work area.

.10 Remove top layer of polyethylene on walls, finishes, and equipment.

.11 Remove remaining polyethylene sheeting.

.12 Remove water hoses and shut off at source.

.13 Remove Signs, Hoarding Walls, Decontamination Facilities.

.14 Seal vacuum hoses and fittings, flexible ductwork and all tools used in contaminated work site in 6 mil polyethylene bags prior to removal from Work Area.

.15 Remove temporary lights.

.16 Remove negative air unit prefilters. Dispose of as hazardous contaminated waste.

.17 Remove HEPA filtered negative pressure machines and discharge ducting.

.18 Immediately upon shutting down negative air units, seal air inlet grill and exhaust vent with polyethylene and tape.

.19 Notify Abatement Consultant to the need for Milestone Inspection - Dismantling Review.

3.7 Re-Establishment of Items

.1 Upon completion of work:

.1 Remove and disconnect Ground fault Panel, tags and locks from electrical panels and re-energize equipment and items.

.2 Remove negative air discharge panel and reinstall glazing to match existing.

.3 Clean, mop and vacuum Abatement Work Area and area beneath Decontamination Facilities.

.4 Enable building air handling systems.

END OF SECTION

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Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

- .1 CSA-A23.1/A23.2 – 'Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete
- .2 CSA-O86 – Engineering Design in Wood
- .3 CSA O121 – Douglas Fir Plywood
- .4 CSA O151 – Canadian Softwood Plywood
- .5 CSA O153 – Poplar Plywood
- .6 CSA S269.1 – Falsework and Formwork
- .7 CAN/CSA-S269.3 – Concrete Formwork

1.2 MEASUREMENT PROCEDURES

.1 No measurement will be made under this Section. Include costs in items of work for which concrete formwork and falsework is required.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit shop drawings for formwork and falsework.

- .1 Upon request, submit drawings stamped and signed by professional engineer registered or licensed in the Province of Manitoba, Canada.

.3 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings. Comply with CAN/CSA-S269.3 for formwork drawings.

.4 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.

Part 2 Products

2.1 MATERIALS

.1 Formwork materials:

- .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA O121, CSA O86, and CSA O153.
- .2 For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.

.2 Pan forms: removable steel, or reinforced plastic to match existing profiles and dimensions.

.3 Tubular column forms: round, internally treated with release material.

.1 Spiral pattern may show in hardened concrete, except where column is designated architectural finish, where it shall not show in hardened concrete.

.4 Form ties:

.1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.

.2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.

.5 Form liner:

.1 Plywood: high density overlay.

.6 Form release agent: non-toxic, biodegradable, low VOC.

.7 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene.

.8 Falsework materials: to CSA-S269.1.

Part 3 Execution

3.1 FABRICATION AND ERECTION

.1 Fabricate and erect falsework in accordance with CSA S269.1.

.2 Refer to drawings for concrete members requiring architectural exposed finishes.

.3 Do not place shores and mud sills on frozen ground.

.4 Provide site drainage to prevent washout of soil supporting mud sills and shores.

.5 Fabricate and erect formwork in accordance with CAN/CSA-S269.1 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.

.6 Align form joints and make watertight. Keep form joints to minimum.

.7 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.8 Construct forms for architectural concrete, and place ties as indicated and as directed. Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.

.9 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections. Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.10 Line forms for following surfaces:

.1 Surfaces designated as architectural finish.

.2 Secure lining taut to formwork to prevent folds.

.3 Pull down lining over edges of formwork panels.

.4 Ensure lining is new and not reused material.

.5 Ensure lining is dry and free of oil when concrete is poured.

.6 Application of form release agents on formwork surface is prohibited where drainage lining is used.

.7 If concrete surfaces require cleaning after form removal, use only pressurized water stream so as not to alter concrete's smooth finish.

.8 Cost of textile lining is included in price of concrete for corresponding portion of Work.

.11 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

.1 Notify Contract Administrator 24 hours in advance prior to removing formwork.

.2 Do not remove forms and bracing until concrete has gained sufficient strength to carry its own weight, construction loads, design loads that are liable to be imposed upon it. Verify strength of concrete by compressive test results.

.3 Leave formwork in place for following minimum periods of time after placing concrete:

LOCATION	TEMPERATURE IN °C		
	21-35	15-21	10-15
Walls	2 days	3 days	4 days
Grade Beams	2 days	3 days	4 days
Side Forms	2 days	3 days	4 days
Slabs *	7 days	7 days	14 days
Beams *	7 days	7 days	14 days
Structural Shoring *	7 days	7 days	14 days

* formwork below/supporting these elements shall remain in place for the minimums stated above and then replaced with shoring posts until concrete is 28 days old. Formwork can be removed and replaced with shoring posts earlier, if concrete test cylinders show a strength of 75% of the required 28 day strength.

.4 Reshore structural members where required due to design requirements or construction conditions and as required to permit progressive construction.

.5 Remove formwork progressively and in accordance with Building and Safety Code requirements and so that no shock loads or unbalanced loads are imposed on structure.

.6 Loosen forms carefully. Do not wedge pry bars, hammers, or tools against concrete surfaces.

.7 Store removed forms, for exposed concrete, so surfaces in contact with fresh concrete will not be damaged. Marked or scored forms will be rejected.

.8 Re-use formwork subject to requirements of CAN/CSA-A23.1.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

- .1 CSA-A23.1/A23.2 – Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete
- .2 CAN/CSA-G30.18 – Carbon Steel Bars for Concrete Reinforcement
- .3 CSA-G40.20/G40.21 – General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel
- .4 CAN/CSA-G164 – Hot Dip Galvanizing of Irregularly Shaped Articles, A National Standard of Canada
- .5 CSA W186 – Welding of Reinforcing Bars in Reinforced Concrete Construction

.2 American Society for Testing and Materials International (ASTM)

- .1 ASTM A1064/1064M – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
- .2 ASTM A775/A775M – Standard Specification for Epoxy-Coated Reinforcing Steel Bars

.3 Reinforcing Steel Institute of Canada (RSIC)

- .1 RSIC Reinforcing Steel Manual of Standard Practice

1.2 MEASUREMENT PROCEDURES

.1 Reinforcing steel will be measured in kilograms of steel incorporated into work, computed from theoretical unit mass specified in CAN/CSA G30.18 for lengths and sizes of bars as indicated.

.2 No measurement will be made under this section.

- .1 Include reinforcement costs in items of concrete work in Section 03 30 00 - Cast-In-Place Concrete.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.

.3 Submit shop drawings including placing of reinforcement and indicate:

- .1 Bar bending details.
- .2 Lists.
- .3 Quantities of reinforcement.

.4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Contract Administrator, with identifying code marks to permit correct placement without reference to structural drawings.

.5 Indicate sizes, spacings and locations of chairs, spacers and hangers.

.4 Detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated.

.1 Provide class B tension lap splices unless otherwise indicated.

Part 2 Products

2.1 MATERIALS

.1 Substitute different size bars only if permitted in writing by Contract Administrator.

.2 Reinforcing steel: All reinforcing steel to be CAN/CSA-G30.18M grade 400R deformed bars except column ties and beam stirrups which shall be grade 400W.

.3 Cold drawn annealed steel wire ties: to ASTM A1064/1064M.

.4 Welded steel wire fabric: to ASTM A1064/A1064M. Provide in flat sheets only.

.5 Epoxy Coating of non-prestressed reinforcement: to ASTM A775/A775M.

.6 Galvanizing of non-prestressed reinforcement: to CAN/CSA-G164, minimum zinc coating 610 g/m^2.

.7 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.

.8 Mechanical splices: subject to approval of Contract Administrator.

.9 Plain round bars: to CSA-G40.20/G40.21.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.2 All reinforcing is to be detailed in accordance with the latest edition of the Reinforcing Steel Institute of Canada - Manual of Standard Practice, except otherwise noted

.3 Obtain Contract Administrator's approval for locations of reinforcement splices other than those shown on placing drawings.

.4 Upon approval of Contract Administrator, weld reinforcement in accordance with CSA W186.

.5 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

.1 Ship epoxy coated bars in accordance with ASTM A775A/A775M.

2.3 SOURCE QUALITY CONTROL

.1 Upon request, provide Contract Administrator with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis.

.2 Upon request inform Contract Administrator of proposed source of material to be supplied.

Part 3 Execution

3.1 FIELD BENDING

.1 Do not field bend or field weld reinforcement, except where indicated or authorized by Contract Administrator.

.2 When field bending is authorized, bend without heat, applying slow and steady pressure.

.3 Replace bars, which develop cracks or splits.

3.2 PLACING REINFORCEMENT

.1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.

.2 Use plain round bars as slip dowels in concrete where noted on the drawings.

.1 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.

.2 When paint is dry, apply thick even film of mineral lubricating grease.

.3 Prior to placing concrete, obtain Contract Administrator's approval of reinforcing material and placement.

.4 Ensure cover to reinforcement is maintained during concrete pour.

.5 Protect epoxy coated portions of bars with covering during transportation and handling.

3.3 DOWELING PROCEDURES

.1 For bars that are indicated as being dowelled in, drill in and epoxy grout bars as follows:

.1 10M bars, 200 mm

.2 15M bars, 250 mm

.3 20M bars, 350 mm

.4 25M bars, 400 mm

.2 Use only approved adhesive to manufacturer's instructions. Acceptable product:

.1 Hilti HIT HY-150 MAX/HIT-ICE by Hilti Canada.

.3 Clean hole thoroughly prior to application of epoxy. Use injection or caulking gun to ensure that the epoxy fills the bottom of the hole prior to embedment of bar.

3.4 FIELD TOUCH-UP

.1 Touch up damaged and cut ends of epoxy coated reinforcing steel with compatible finish to provide continuous coating.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

- .1 ASTM C260/C250M – Standard Specification for Air-Entraining Admixtures for Concrete
- .2 ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
- .3 ASTM C330/C330M – Standard Specification for Lightweight Aggregates for Structural Concrete
- .4 ASTM C494/C494M – Standard Specification for Chemical Admixtures for Concrete
- .5 ASTM C1017/C1017M – Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
- .6 ASTM D412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension
- .7 ASTM D624 – Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer
- .8 ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
- .9 ASTM D1752 – Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-37-GP-9Ma – Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing
- .2 CAN/CGSB-51.34 – Vapour Barrier, Polyethylene Sheet for Use in Building Construction

.3 Canadian Standards Association (CSA International)

- .1 CSA-A23.1/A23.2 – Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete
- .2 CSA A283 – Qualification Code for Concrete Testing Laboratories
- .3 CAN/CSA-A3000 – Cementitious Materials Compendium (consists of A3001, A3002, A3003, A3004 and A3005)
  - .1 CSA-A3001 – Cementitious Materials for Use in Concrete

.4 International Concrete Repair Institute (ICRI)

- .1 ICRI Guideline No. 310.2R – Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair

.5 American Concrete Institute (ACI)

.1 ACI 355.4 – Qualification of Post-installed Adhesive Anchors in Concrete

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Certificates:

.1 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.

.2 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.

.3 Concrete pours: submit accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.

.4 Concrete hauling time: submit for review by Contract Administrator deviations exceeding maximum allowable time of 120 for concrete to be delivered to site of Work and discharged after batching.

1.3 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Submit to Contract Administrator, minimum four (4) weeks prior to starting concrete work, valid and recognized certificate from plant delivering concrete.

.1 When plant does not hold valid certification, provide test data and certification by qualified independent inspection and testing laboratory that materials used in concrete mixture will meet specified requirements.

.3 Minimum four (4) weeks prior to starting concrete work, submit proposed quality control procedures for review by Contract Administrator on following items:

.1 Falsework erection.

.2 Hot weather concrete.

.3 Cold weather concrete.

.4 Curing.

.5 Finishes.

.6 Formwork removal.

.7 Joints.

.4 Quality Control Plan: submit written report, as described in PART 3 - VERIFICATION, to Contract Administrator verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.

.1 Modifications to maximum time limit must be agreed to by Contract Administrator and concrete producer as described in CSA A23.1/A23.2.

.2 Deviations to be submitted for review by Contract Administrator.

.2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

1.5 INSPECTION AND TESTING

.1 Inspection and testing to be performed by a firm approved by the Contract Administrator and paid for by Cash Allowance, as described in Section 01 21 00.

.2 Provide free access to all portions of the work and co-operate with appointed firm.

.3 Three concrete test cylinders will be taken for every 50 or less cubic meters or each day concrete is placed whichever is less.

.4 One slump test will be taken for each set of test cylinders taken.

.5 Testing of concrete to be performed in accordance with CSA A23.2.

.6 Pay costs for retesting if required.

.7 Poat-installed adhesive anchors shall be inspected by an independent agency certified to perform anchor installation inspections, including installation of anchors in a horizontal or upwardly-inclined orientation. Inspections to be as follows:

.1 For anchors installed in a downward orientation, periodic special inspections shall be done as per ACI 355.4. Inspections shall be done for the first of each type of anchor installation, and then periodically for 25% of remaining anchors.

.2 For anchor installed in a horizontal or upwardly-inclined orientation, including overhead installations, continuous special inspections shall be done as per ACI 355.4 for all anchors.

.3 Special inspector to provide report confirming that work covered by the report has been performed and that the materials used, and the installation procedures used, conform with the approved contract documents and the manufacturer's printed installation instructions.

Part 2 Products

2.1 MATERIALS

.1 The concrete constituents shall comply with the following standards:

- .1 Cement: to CAN/CSA-A3001.
- .2 Blended hydraulic cement: to CAN/CSA-A3001.
- .3 Supplementary cementing materials: to CAN/CSA-A3001.
- .4 Water: to CSA-A23.1.
- .5 Aggregates: to CAN/CSA-A23.1/A23.2.
- .6 Admixtures:
  - .1 Air entraining admixture: to ASTM C260.
  - .2 Chemical admixture: to ASTM C494 and ASTM C1017. Contract Administrator to approve accelerating or set retarding admixtures during cold and hot weather placing.

2.2 CONCRETE MIX REQUIREMENTS

.1 Refer to General Notes on Drawings for concrete mix requirements.

.2 Performance Method for specifying concrete: to meet Contract Administrator performance criteria in accordance with CAN/CSA-A23.1/A23.2.

- .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as described in PART 3 - VERIFICATION.
- .2 Provide quality management plan to ensure verification of concrete quality to specified performance.
- .3 Concrete supplier's certification.

2.3 ACCESSORIES

.1 Evaporation retardant: Acceptable Product:

- .1 MasterKure ER 50, formerly (Confilm) by BASF Building Systems at a minimum application rate of 4.9 m^2/L.

.2 Cure and sealing compound: to ASTM C309, Type 1. Acceptable product(s):

- .1 Florseal WB by Sika Canada Inc. at a minimum application rate of 4.9 m^2/L.
- .2 MasterKure CC, formerly (Kure-N-Seal) by BASF Building Systems at a minimum application rate of 4.9 m^2/L.

.3 Vapour Barrier: 10 mil polyethylene film to CAN/CGSB-51.34 unless otherwise noted on Drawings.

.4 Grout: Portland Cement based non-shrink, non-metallic composition and shall meet the following requirements:

.1 The grout shall not exhibit bleeding or segregation at pumpable consistency.

.2 Compressive Strength: 25 MPa @ 1 day.

.3 Bond Strength (ASTM C882) 13 MPa @ 28 days.

.4 Positive expansion confirmed by ASTM C827.

.5 The grout shall not produce a vapour barrier.

.6 Acceptable products are one of the following only:

.1 Sika Grout 212 by Sika Canada Inc.

.2 Sternson M-Bed Standard by Sternson Construction Products.

.5 Non premixed dry pack grout: composition of non-metallic aggregate Type GU cement with sufficient water for mixture to retain its shape when made into ball by hand and capable of developing compressive strength of 25 MPa at 28 days.

.6 Premoulded joint fillers:

.1 Bituminous impregnated fiber board: to ASTM D1751.

.2 Sponge rubber: to ASTM D1752, Type I, flexible grade.

Part 3 Execution

3.1 PREPARATION

.1 Obtain Contract Administrator's approval before placing concrete.

.1 Provide minimum 48 hours notice prior to placing of concrete.

.2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.

.3 During concreting operations:

.1 Development of cold joints not allowed.

.2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.

.4 Ensure reinforcement and inserts are not disturbed during concrete placement.

.5 Prior to placing of concrete obtain Contract Administrator's approval of proposed method for protection of concrete during placing and curing in adverse weather.

.6 Protect previous Work from staining.

.7 Clean and remove stains prior to application for concrete finishes.

.8 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.9 In locations where new concrete is dowelled to existing work, drill holes in existing concrete for dowels as noted on structural drawings.

.10 Do not place load upon new concrete until authorized by Contract Administrator.

3.2 CONSTRUCTION

.1 Do cast-in-place concrete work in accordance with CSA-A23.1/A23.2.

.2 Sleeves and inserts:

.1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by Contract Administrator.

.2 Where approved by Contract Administrator, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.

.3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by Contract Administrator.

.4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Contract Administrator before placing of concrete.

.5 Check locations and sizes of sleeves and openings shown on drawings.

.6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

.3 Anchor bolts:

.1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.

.2 With approval of Contract Administrator, grout anchor bolts in preformed holes or holes drilled after concrete has set. Formed holes to be minimum 100 mm diameter. Drilled holes to manufacturers' recommendations.

.3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.

.4 Set bolts and fill holes with shrinkage compensating grout or chemical grout, as approved by Contract Administrator.

.5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.

.4 Drainage holes and weep holes:

.1 Form weep holes and drainage holes in accordance with Section 03 10 00 - Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.

.2 Install weep hole tubes and drains as indicated.

.5 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.

.6 Finishing:

.1 Finish concrete in accordance with CSA-A23.1/A23.2.

.1 Concrete tolerance in accordance with CSA-A23.1/A23.2

FF = 25: FL = 20.

.2 Use curing methods compatible with applied finish on concrete surfaces.

.7 Curing:

.1 Cure and protect concrete in accordance with requirements CSA A23.1.

.2 Unless noted otherwise the curing regime shall be consistent with the Class of Exposure. See General Notes on structural drawing for Class of Exposure.

.8 Waterstops:

.1 Install waterstops to provide continuous water seal.

.2 Do not distort or pierce waterstop in way as to hamper performance.

.3 Do not displace reinforcement when installing waterstops.

.4 Use equipment to manufacturer's requirements to field splice waterstops.

.5 Tie waterstops rigidly in place.

.6 Use only straight heat-sealed butt joints in field.

.7 Use factory welded corners and intersections unless otherwise approved by Contract Administrator.

.9 Joint fillers:

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Contract Administrator.

.2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.3 Locate and form isolation and construction joints as indicated, where applicable.

.4 Install joint filler.

.5 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.

3.3 FIELD QUALITY CONTROL

.1 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory approved by Contract Administrator for review in accordance with CSA-A23.1/A23.2.

.1 Ensure testing laboratory is certified in accordance with CSA A283.

.2 Frequency and Number of Tests:

.1 Concrete Tests:

.1 Not less than one strength test per 50 cubic metres of concrete placed and not less than one test for each class of concrete placed on any one day.

.2 Air measurements will be completed on each of the initial 3 loads of concrete per day of casting to ensure satisfactory control of the air content is established. If adequate control of air content is not established within the first 3 loads of concrete or if a test falls outside the specified limits, the testing frequency shall revert to one test per load until satisfactory control is re-established. Costs for additional testing will be the responsibility of the concrete supplier.

.3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and Contract Administrator.

.4 Contract Administrator may take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

.5 Non-Destructive Methods for Testing Concrete: in accordance with CSA-A23.1/A23.2.

.6 Inspection or testing by Testing Agency will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

3.4 VERIFICATION

.1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established in PART 2 - Products, by Contract Administrator and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

3.5 DEFECTIVE CONCRETE

.1 Defective concrete: cracking, spalling, scaling and concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements.

.2 Repair or replacement of defective concrete will be determined by the Contract Administrator, based on the specifications and the above guidelines.

.3 Do not patch, fill, touch-up, repair or replace exposed concrete except upon express direction of consultant for each individual use.

.4 Modify or replace concrete not conforming to lines, detail and elevations indicated on drawings.

.5 Repair or replace concrete not properly placed, resulting in excessive honeycombing and other defects in critical areas of stress.

.6 Notify Contract Administrator of proposed methods of repairing or replacing defective concrete. Methods of repairing or replacing defective concrete shall be acceptable to the Contract Administrator.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

.2 Canadian Standards Association (CSA)

.1 CAN/CSA-A23.1/A23.2 – Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete

1.2 QUALITY ASSURANCE

.1 Do concrete floor finishing to CAN/CSA-A23.1, except where specified otherwise.

.2 Concrete curing shall comply with CAN/CSA-A23.1, except where specified otherwise.

.3 Curing compounds shall conform to ASTM C309.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Curing: use clean, potable water, which shall not contain impurities, which would cause staining.

.2 Curing compounds: AR-30 by Meadows, Ritecure by Sternson, CPD Clear Cure, and Elsro #705 Clear Curing Compound, or approved equal.

.3 Cure and seal: SealTight CS-309 by Meadows, Florseal by Sternson, CPD Acrylic Cure and Seal, Elsro #702 Clear Acrylic Sealer, or approved equal.

.4 Bonding agent: Daraweld “C” by Grace, SCP AcriStix latex bonding agent, or approved equal.

Part 3 EXECUTION

3.1 WORKMANSHIP

.1 Concrete slabs, which are to receive bonded toppings, shall be cleaned free of dirt, oil, loose material and laitance.

.2 Concrete slabs to receive toppings, quarry tile, or ceramic tile, to be screeded off to true lines and levels shown and left ready to receive finish. Depress slabs to accommodate finish.

.3 Steel trowel all concrete slabs to be left exposed, or receiving carpeting, resilient flooring and applied floor finishes.

3.2 PLAIN FLOOR FINISH

.1 Spread and vibrate concrete to force coarse aggregate into concrete mix, and then screed.

.2 Float surface with wood or metal floats, or with power finishing machine, and bring surface to true grade.

.3 Steel trowel in accordance with CAN/CSA-A23.1. Trowel to level, even surface, to within 3mm (1/8”) tolerance when measured in any direction using a 3m (10ft) straight edge.

.4 Continue steel trowelling to produce smooth burnished surface.

.5 Sprinkling of dry cement, or dry cement and sand mixture over concrete surfaces is not acceptable.

.6 Saw cut crack-control joints to CAN/CSA-A23.1.

.7 Apply cure and seal compound to all interior floor surfaces, unless specified otherwise. Do not apply cure and seal to concrete receiving epoxy finishes.

.8 Apply curing compound to all exterior concrete such as exterior paving, curbs and sidewalks. Note: Cure and seal compounds may not be used until 28 days after placement.

.9 Wet curing: wet cure exposed concrete floors using polyethylene sheeting over entire floor area, weighted down and taped on all edges for total sealing of wetted down concrete, and keep in place a minimum of seven (7) days. Protect the surface from direct sunlight to avoid overheating.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society of Testing and Materials (ASTM)

.1 ASTM C119 – Standard Terminology Relating to Dimension Stone

.2 ASTM C568/C568M – Standard Specification for Limestone Dimension Stone

.2 Canadian Standards Association (CSA)

.1 CSA-A165 – CSA Standards on Concrete Masonry Unit covers: A165.1, A165.2, A165.3

.2 CSA-A179 – Mortar and Grout for Unit Masonry

Part 2 PRODUCTS

2.1 STONE FACING UNITS

.1 Limestone shall be as quarried and supplied by Gillis Quarries Ltd., standard grade.

.2 Stone shall be Manitoba Tyndall Stone; a medium density cut dimension limestone per ASTM C119, and ASTM C568. Stone shall be free from all defects, which would affect appearance or durability. Quarry seams shall be well back from finished face. Fossils and other natural markings permitted only to the extent that they do not disfigure finished appearance. Loose or large white fossils not permitted. Projections from split face stone shall be uniform in appearance. Any units with large or unacceptable projections shall be removed from site, as directed by Contract Administrator.

.3 Colour: to match existing.

.4 Face: split face and sawn face.

.5 Size: 90mm thick, height and length to match existing.

2.2 CONCRETE BLOCK

.1 Standard concrete block units: to CAN/CSA-A165 Series (CAN/CSA-A165.1).

.1 Classification: H/15/A/M.

.2 Size: Modular – Mason to confirm whether existing block is imperial or metric prior to ordering block and order to match existing.

2.3 TOLERANCES

.1 Tolerances for standard concrete unit masonry tolerances in accordance with CAN/CSA A165.1, supplemented as follows:

.1 Maximum variation between units within specific job lot not to exceed 2mm.

.2 No parallel edge length, width or height dimension for individual unit to differ by more than 2mm.

.3 Out of square tolerance not to exceed 2mm.

.2 Tolerances for architectural concrete masonry units in accordance with CAN/CSA A165.1, supplemented as follows:

.1 Maximum variation in length or height between units within specific job lot for specified dimension not to exceed 2mm.

.2 No parallel edge length, width or height dimension for individual unit to differ by more than 2mm.

.3 Out of square tolerance not to exceed 2mm.

.4 Maximum variation in width between units within specific job lot for specified dimension not to exceed 2mm.

2.4 MORTAR MATERIALS

.1 Use same brands of materials and source of aggregate for entire project to ensure uniformity of colouration and other mix characteristics.

2.5 MORTAR TYPES

.1 All mortar for masonry shall be Type S, based on Proportion specifications of CSA-A179 (including water repellant additive).

.2 Mortar for pointing: Type N, based on Proportion specifications of CSA-A179.

.3 White mortar (for stonework or white block): use normal sand, white Portland cement, and lime or white silica sand and white masonry cement, to produce applicable mortar type.

.4 Non-staining mortar (for stonework): use non-staining masonry cement for cementitious portion of specified mortar type.

.5 Dirt-resistant mortar: add aluminum tristearate, calcium stearate, or ammonium stearate to mortar in amount of three percent (3%) of weight or Portland cement.

Part 3 EXECUTION

Refer to Section 04 20 00, Masonry Procedures.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA)

- .1 CSA-A165 – CSA Standards on Concrete Masonry Units covers: A165.1, A165.2, A165.3
- .2 CSA-A179 – Mortar and Grout for Unit Masonry
- .3 CSA-A370 – Connectors for Masonry
- .4 CSA-A371 – Masonry Construction for Buildings
- .5 CAN/CSA-S16 – Limit States Design of Steel Structures

1.2 QUALITY ASSURANCE

.1 Do masonry work to CSA-A371, except where specified otherwise.

.2 Masonry work shall be carried out by a company specializing in performing the work of this section with a minimum five (5) years documented experience, and be a member in good standing with the Manitoba Masonry Contractors Association (MMCA).

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

.1 Cementitious materials and aggregates shall be stored in such a manner as to prevent deterioration or intrusion of foreign material.

.2 Supplement Clause 5.16.1 of CSA-A371 as follows:

- .1 Ensure that materials are delivered to jobsite in dry condition.
- .2 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.
- .3 Provide plywood sheets between pallets on trucks, to reduce masonry damage in transit.

1.4 TESTING AND REVIEW

.1 Testing of mortar cube specimens shall be performed by a firm acceptable to the Contract Administrator and paid by cash allowance, refer to Section 01 21 00, Allowances. This shall include a site visit to take the first set of mortar specimens and demonstrate proper sampling procedure to the Contractor.

.2 Thereafter, the Contractor shall take mortar cube specimens when directed by the Contract Administrator or as follows:

- .1 Mortar for concrete block shall be tested at least once:
  - .1 For each $500m^2$ of masonry or portion thereof, for a project having more than $500m^2$ of masonry.

.2 For each 250m^2 of masonry or portion thereof, for a project having less than 500m^2 of masonry.

.2 Mortar for masonry veneer shall be tested at least once

.1 For each 250m^2 of masonry or portion thereof, for a project having more than 250m^2 of masonry.

.2 For each 125m^2 of masonry or portion thereof, for a project having less than 250m^2 of masonry.

.3 This Contractor shall be responsible for proper storage and delivery of the specimens as prescribed by the testing agency.

.4 Each set of specimens shall consist of six (6) mortar cubes to be tested as follows: two (2) 7-day tests, and four (4) 28-day tests.

.5 Provide inspection agency with an accurate description and location of area from which specimens were taken, to be recorded on the test reports.

.6 Testing of mortar shall be performed in accordance with CSA-A179.

1.5 PROTECTION

.1 Until complete and protected by flashings or other permanent construction, keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain.

.2 Protect masonry and other Work from marking and other damage. Protect completed Work from mortar droppings. Use non-staining coverings.

1.6 MAINTENANCE DATA

.1 Provide maintenance data on graffiti removal product, including instructions on cleaning products and correct use.

Part 2 PRODUCTS

2.1 MASONRY ACCESSORIES

.1 Backer rod: purpose-made, expanded polyethylene, elastomar, closed cell, sheet, nominal density 2.7 p.c.f. Standard of acceptance: Ethafoam by Dow or PermaStik 2220, of size indicated, or approved equal.

.2 Base flashing:

.1 Galvanized steel sheet: minimum 0.38mm (0.015") Nominal Base Steel Thickness (NBST), commercial quality, with Z275 designation zinc coating.

.2 Pre-finished steel sheet, minimum 0.38mm (0.015”) NBST, Grade A steel, with Z275 designated zinc coating with Series 8000 Plus baked enamel finish. Colour to be selected.

.3 Perm-A-Barrier Membrane, as manufactured by W.R. Grace & Co. of Canada Ltd., Blueskin TWF, as manufactured by Bakor, and Sopraseal 60 F/F, as manufactured by Soprema, or approved equal.

.3 Drip flashing: pre-finished steel sheet, minimum 0.38mm (0.015") NBST, Grade A steel, with Z275 designation zinc coating with Series 8000 Plus baked enamel finish. Colour to be selected.

.4 Flashing reglets: purpose-made, galvanized steel for setting flashings into concrete.

.5 Neoprene closure strips, of thickness required, continuous lengths.

.6 Anti-graffiti sealant: silicone rubber based sealant. Standard of acceptance: Professional Water Sealant Anti-Graffitiant, as distributed by Alsip's, or approved equal. Approved equal: Fabrishield PR61 Paint Repellant, Anti-Graffiti and Water Repellant, as distributed by IXL Brick.

2.2 MASONRY REINFORCING AND TIEING MATERIALS

.1 Shear connectors: Block Shear Connectors, available from Expocrete Concrete Products Ltd., consisting of connector plate, Vee-Tie, and insulation support.

.1 Connector plate: 1.6mm (16ga.) sheet steel, stainless steel finish. For insulated cavity walls, length of plate to suit insulation thickness.

.2 Vee tie: 5mm (3/16") diameter, cold drawn steel wire, stainless steel finish. Length to extend to mid-point of masonry veneer, but not closer than 25mm (1") from exposed face.

.3 Insulation support: polyethylene, purpose made for insertion over connector plate to hold insulation boards tight to back-up wall.

.2 Veneer connectors: Rap-Tie Connectors, available from Forte Construction Systems, or Dur-O-Wall adjustable veneer anchor assembly DA213, available from G.D. Johnson, consisting of the following:

.1 Anchor plate connector: 1.6mm (16 ga.) sheet steel, stainless steel finish. For insulated cavity walls, length of plate to suit insulation thickness.

.2 Wire-tie: 5mm (3/16") diameter, cold drawn steel wire, stainless steel finish. Length to extend to mid-point of masonry veneer, but not closer than 25mm (1") to exposed surface.

.3 Insulation support: polyethylene, purpose made for insertion over connector plate to hold insulation boards tight to back up wall.

.4 Fasteners: 5mm (3/16") Tapcon hex-head fasteners, two (2)/plate.

.3 Conventional connectors shall conform to Section 9 of CSA-A370, and as follows:

.1 Standard corrugated strip ties, conforming to Clause 9.5.1, shall be used to anchor masonry to steel beams, and where indicated.

.2 Standard continuous welded ladder and truss ties/reinforcing, 4.76mm (3/16") diameter, conforming to Clause 9.5.4., shall be used for masonry reinforcing.

.4 Connectors shall have corrosion resistance in accordance with Section 4 of CSA-A370.

.5 Vertical reinforcing steel in accordance with Section 03 20 00 - Concrete Reinforcement and structural drawings.

2.3 SEALANTS AND CAULKING

.1 Sealants and caulking shall comply with Section 07 92 00 - Joint Sealants.

2.4 STEEL LINTELS

.1 Fabrication and erection of steel lintels shall conform to Section 05 12 23 - Structural Steel.

Part 3 EXECUTION

3.1 CLIMATIC CONDITIONS

.1 Conform to Clauses 6.7.2 and 6.7.3 of CSA-A371, for cold weather requirements, protection requirements, and as follows: air temperatures shall be the minimum recorded by Environment Canada for the area for the 48 hour period.

.2 When air temperature is below 5°C, take the following precautions in preparing and using mortar:

.1 Heat sand slowly and evenly, but do not scorch. Do not use scorched sand, having a reddish cast, in mortar.

.2 Heat water to 70°C maximum.

.3 After combining heated ingredients, maintain temperature of mortar between 5°C and 50°C, until used.

.4 Completely cover with insulation tarps for 48 hours.

.3 When air temperature is below -4°C, protect and heat masonry to maintain air temperature above 0°C on both sides of walls during operations, and for period of 48 hours after.

.4 When air temperature is below -4°C, erect windbreaks to prevent differential freezing of walls.

.5 Maintain dry beds for masonry, and use dry masonry units only. Do not wet masonry units in winter.

.6 During hot weather, protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.

3.2 MEASUREMENT AND MIXING OF MORTAR

.1 Measurement and mixing of mortar shall be done in accordance with Clause 6 of CSA-A179, supplemented as follows:

.1 Mix grout to semi-fluid consistency.

.2 Incorporate colour into mixes in accordance with manufacturer's instructions.

.3 Use clean mixer for coloured mortars.

.4 Pre-hydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp, workable mix that will retain its form when pressed into a ball. Allow standing for not less than one (1) hour, nor more than two (2) hours, then re-mix with sufficient water to produce mortar of proper consistency for pointing.

3.3 MASONRY FLASHING

.1 Masonry flashings shall comply with Clause 5.13.5 of CSA-A371, and as follows:

.1 Install flashing as shown under exterior masonry bearing on foundation walls, slabs, shelf angles, and steel angles over openings. Install flashing under weep hole courses. Install flashing elsewhere as indicated.

.2 In double wythe walls and veneered walls, carry flashing from front edge of veneer to back up wall, then up backing not less than 150mm (6").

3.4 ERECTION

.1 Verify lines, levels and dimensions prior to laying masonry. Notify Contract Administrator of discrepancies.

.2 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

.3 Lay limestone as recommended by supplier to match existing, and as follows:

.1 Clean stone by washing with water before laying

.2 Stagger vertical for balanced appearance in ashlar coursing, all vertical joints sawn

.3 Pointing split face: vertical joints pack flush, horizontal joints tool slightly

.4 Pointing sawn face: pack joints, tool slightly concave

.4 Build masonry plumb, level, and true to line, with vertical joints in proper alignment, within construction tolerances, refer to Clause 5.3 of CSA-A371.

.5 Remove chipped, cracked, and otherwise damaged units in exposed masonry and replace with undamaged units.

.6 Cull out masonry units, in accordance with CAN/CSA A165 and reviewed range of colour samples, with chips, cracks, broken corners, excessive colour and texture variation.

.7 In each wythe of masonry in running bond, install continuous welded ladder or truss type horizontal reinforcement, at vertical spacing of 400mm (16”) maximum. Install reinforcing in accordance with Section 5.4 of CSA-A371, with minimum 300mm (12") laps, staggered minimum 750mm (30").

.8 Bond wythes of multiple wythe walls with ties or reinforcing installed as above.

.9 Connect masonry veneer to backing, in accordance with Clause 5.6.2 of CSA-A371, with tie spacing beginning within 400mm (16”) of base of wall or support, and within 300mm (12") of openings and tops of walls, and as follows:

.1 Shear connectors: 600mm (24") vertical and 800mm (32") horizontal spacing maximum. Install shear ties with vertical leg up.

.2 Veneer connectors: 600mm (24") vertical and [600mm (24")][800mm (32”)] horizontal spacing maximum.

.10 Allow for movement as follows:

.1 Leave 6mm (1/4") space, and do not use wedges between tops of non-load bearing walls/partitions and structural elements.

.2 Leave 3mm (1/8") space below shelf angles.

.3 Fill and seal gaps in exterior walls to maintain air/vapour barrier and weatherproofing. Use Ethafoam rod backing and sealant.

.11 Install metal closure plates and angles to close off exposed openings in non-load bearing walls.

.12 Provide 55mm (2-1/4") high weeper openings, in exterior wythes of cavity walls, immediately over flashings and at base of facing, at horizontal spacing not exceeding 800mm (32") on centre.

.13 Where necessary to temporarily stop horizontal runs of masonry, and in building corners, step-back masonry diagonally to top course previously laid. Do not “tooth” new masonry. Fill in adjacent courses before heights of stepped masonry reach 1200mm (4ft).

.14 Provide a continuous vertical joint, raked and tooled, where one wall abuts perpendicular to another, and where shown. Reinforce across joints with corrugated ties at 400mm (16") on centre.

.15 Provide temporary bracing of masonry Work, during and after erection, until permanent lateral support is in place. Do not remove bracing from cavity wall until both wythes are in place.

3.5 JOINTING

.1 Mortar joints shall be 10mm (3/8") ± 1.5mm (1/16"), unless otherwise noted.

.2 Joints shall be tooled, where indicated, with a jointer, when the mortar becomes “thumb-print” hard.

.3 Mortar joints shall be to CSA-A371, Clause 5.2, and as follows:

.1 Where concave joints are specified, allow joints to set just enough to remove excess water, then tool with round jointer to provide smooth, compressed, uniformly concave joints

.2 Where joints are concealed in walls and where walls are to receive tile, insulation, or other applied material except paint or similar thin finish coating, strike flush

3.6 CONTROL JOINTS

.1 Provide continuous vertical control joints in exterior and interior walls and partitions as follows:

.1 Straight walls – exterior: maximum 8m (26ft)

.2 Straight walls – interior: maximum 9m (30ft)

.3 At all changes in wall thickness

.4 At abrupt changes in wall height

.5 Above joints in foundations and floors

.6 Keep minimum 400mm (16") clear each side of openings

.2 Install continuous control joint fillers and sealant per spec detail.

.3 Stop reinforcing at every fourth course, each side of control joints, unless otherwise shown.

3.7 LINTELS AND BOND BEAMS

.1 Reinforced masonry lintels and bond beams:

.1 Erect shoring as required to support the lintel, without deflection, to allow the concrete to cure to minimum 7-day strength.

.2 Place masonry lintels and bond beams as indicated on drawings, with joints to match adjacent wall. Note: minimum 400mm (16") bearing each end for lintels type L-2 and larger.

.3 Install reinforcing, adequately supported, to maintain minimum 19mm (3/4") cover all around.

.4 Place concrete in accordance with Division 3 and vibrate thoroughly.

.5 Protect curing concrete from harmful shock or vibration. Replace damaged or otherwise weakened lintels.

.6 Install reinforced concrete block bond beams at tops of all load-bearing walls, and as indicated.

.2 Structural steel lintels:

.1 Loose and fastened angle lintels shall have a minimum 200mm (8") bearing each end.

.2 Steel beam lintels shall be installed on bearing plates, in accordance with spec details.

3.8 BUILDING-IN

.1 Build-in items required to be built into masonry.

.2 Prevent displacement of built-in items during construction. Check for plumbness, alignment and correctness of position, as Work progresses.

.3 Brace door jambs to maintain plumbness. Fill spaces between jambs and masonry with mortar.

.4 Cut out neatly for electrical switches, outlet boxes, and other recessed or built-in objects.

.5 Make cuts straight, clean and free from uneven edges. Use masonry saw, where needed.

.6 Embed bolts and anchors solidly in mortar or grout to develop maximum resistance to design forces.

.7 Cut and fit for chases, pipes, conduit, sleeves and grounds. Cooperate fully with other sections of Work to ensure correct size, shape and location.

3.9 EXISTING WORK

.1 Provide for making good and patching of existing Work, including cutting and patching for mechanical and electrical Work. Use materials to match existing.

.2 Note areas where imperial height block is required.

.3 Tooth-in new Work when filling in existing openings or marking new openings in existing walls.

3.10 CONCRETE FILL

.1 Where concrete fill is used in lieu of solid units, use 20MPa concrete as specified in Section 03 30 00, Cast-In-Place Concrete.

.2 Install building paper below voids to be filled with concrete, keep paper 25mm (1”) back from faces of units.

.3 Where detailed on structural drawings, provide clean block cores to receive concrete and reinforcement. Provide opening at bottom for clean out and inspection.

3.11 SEALANTS

.1 Apply sealants in accordance with Section 07 92 00, Joint Sealants.

3.12 CLEANING

.1 Allow mortar droppings on concrete masonry to partially dry, then remove by means of trowel, followed by rubbing lightly with small piece of block, and finally by brushing.

.2 Clean stone as follows:

.1 After mortar has completely set and each day, brush stonework with stiff fibre bristle brush, dry or minimum amount of clean water. Do not use wire brushes, acids or acidic or alkaline cleaning compounds. Rinse with clean water to remove accumulation of foreign matter, if necessary.

3.13 ANTI-GRAFFITI SEALANT

.1 When thoroughly dry, apply two (2) coats of the silicone rubber based sealant. Use brush, roller, or low-pressure spray. Apply per manufacturer's instructions.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM) International Inc.

.1 ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

.2 ASTM A490 – Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric)

.3 ASTM A3125/3125M – Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength. (Replaces A325-14)

.2 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA)

.1 Handbook of the Canadian Institute of Steel Construction

.2 CISC/CPMA Standard 2-75, Quick-Drying Primer for use on Structural Steel

.3 CISC/CPMA 1-73a, Quick-Drying, One-Coat Paint for Use on Structural Steel

.3 Canadian Standards Association (CSA International)

.1 CSA G40.20/G40.21 – General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel

.2 CAN/CSA-G164 – Hot Dip Galvanizing of Irregularly Shaped Articles

.3 CAN/CSA-S16 – Limit States Design of Steel Structures.

.4 CAN/CSA-S136 – North American Specifications for the Design of Cold Formed Steel Structural Members

.5 CSA W47.1 – Certification of Companies for Fusion Welding of Steel.

.6 CSA W55.3 – Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings

.7 CSA W59 – Welded Steel Construction (Metal Arc Welding)

.4 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE) International

.1 SSPC SP-2, Hand Tool Cleaning

.2 SSPC SP-7, Brush-off Blast Cleaning

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings:

.1 Provide drawings stamped and signed by professional engineer registered or licensed in the Province of Manitoba, Canada.

.3 Erection drawings:

.1 Submit erection drawings indicating details and information necessary for assembly and erection purposes including:

.1 Description of methods.

.2 Sequence of erection.

.3 Type of equipment used in erection.

.4 Temporary bracings.

.4 Fabrication drawings:

.1 Submit fabrication drawings showing designed assemblies, components and connections are stamped and signed by qualified professional engineer licensed in the Province of Manitoba, Canada.

.5 Samples:

.1 Upon request, prepare sample of typical exposed structural connections in accordance with AISC Specifications of Architecturally exposed structural steel for approval of Contract Administrator. Samples to be judged upon alignment of surfaces, uniform contact between surfaces, smoothness and uniformity of finished welds. When approved, sample units will serve as a standard for workmanship, appearance and material acceptable for entire project.

.6 Source Quality Control Submittals:

.1 Submit two (2) copies of mill test reports four (4) weeks prior to fabrication of structural steel.

.1 Mill test reports to show chemical and physical properties and other details of steel to be incorporated in project.

.2 Provide mill test reports certified by metallurgists qualified to practice in the Province of Manitoba, Canada.

.7 Fabricator Reports:

.1 Upon request, provide structural steel fabricator's affidavit stating that materials and products used in fabrication conform to applicable material and products standards specified and indicated.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials in manufacturer's original, undamaged containers with identification labels intact.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 Design details and connections in accordance with requirements of CAN/CSA-S16 and CAN/CSA-S136 with CSA-S136.1 to resist forces, moments, shears and allow for movements indicated.

.2 Shear connections:

.1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction" when connection for shear only (standard connection) is required.

.2 Select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam, when shears are not indicated.

.3 Upon request, submit sketches and design calculations stamped and signed by qualified professional engineer licensed in the Province of Manitoba, Canada, for non standard connections.

2.2 MATERIALS

.1 Structural steel: All rolled or steel structural sections shall be G40.21-350W. All Hollow structural sections to be G40.21-350W class C. All angles, channels and plates shall be G40.21-300W.

.2 Anchor bolts: to CSA-G40.20/G40.21, Grade 300W.

.3 Bolts, nuts and washers: to ASTM A307, ASTM A3125M, and ASTM A490/A490M as required.

.4 Welding materials: to CSA W59 and certified by Canadian Welding Bureau.

.5 Shop paint primer:

.1 Steel not receiving finish painting: one coat of CISC/CPMA 1-73A quick drying shop primer

.2 Steel receiving finish painting: one coat of CISC/CPMA 2-75 quick drying shop primer.

.6 Hot dip galvanizing: galvanize steel, where indicated, to CAN/CSA-G164, minimum zinc coating of 600 g/m^2.

.7 Shear studs: to CSA W59, Appendix H.

2.3 FABRICATION

.1 Fabricate structural steel in accordance with CAN/CSA-S16, CAN/CSA-S136, and in accordance with reviewed shop drawings.

.2 Continuously seal members by continuous welds where indicated. Grind smooth.

2.4 SHOP PAINTING

.1 Clean, prepare surfaces and shop prime structural steel as follows:

.1 Steel not receiving finish painting: One coat of CISC / CPMA 1-73a quick drying shop primer. Steel to be cleaned in conformance with SSPC-SP2.

.2 Steel receiving finish painting: One coat of CISC / CPMA 2-75 quick drying shop primer. Steel to be cleaned in conformance with SSPC-SP7.

.3 Exterior structural steel: All exterior structural steel shall be hot-dipped galvanized unless noted otherwise.

.2 Clean members, remove loose mill scale, rust, oil, dirt and foreign matter.

.3 Apply one coat of primer in shop to steel surfaces, except:

.1 Surfaces to be encased in concrete.

.2 Surfaces and edges to be field welded.

.3 Faying surfaces of slip-critical connections.

.4 Below grade surfaces in contact with soil.

.4 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.

.5 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.

.6 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

Part 3 Execution

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 GENERAL

.1 Structural steel work: in accordance with CAN/CSA-S16, CAN/CSA-S136.

.2 Welding: in accordance with CSA W59.

.3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

3.3 CONNECTION TO EXISTING WORK

.1 Verify dimensions and condition of existing work, report discrepancies and potential problem areas to Contract Administrator for direction before commencing fabrication.

3.4 MARKING

.1 Mark materials in accordance with CSA G40.20/G40.21. Do not use die stamping. When steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.

.2 Match marking: shop mark bearing assemblies and splices for fit and match.

3.5 ERECTION

.1 Erect structural steel, as indicated and in accordance with CAN/CSA-S16, CAN/CSA-S136, and in accordance with reviewed erection drawings.

.2 Field cutting or altering structural members: to approval of Contract Administrator.

.3 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.

.4 Continuously seal members by continuous welds where indicated. Grind smooth.

3.6 FIELD QUALITY CONTROL

.1 Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Contract Administrator.

.2 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Contract Administrator.

.3 Submit test reports to Contract Administrator within two (2) weeks of completion of inspection.

.4 Owner will pay costs of tests as specified in Section 01 21 00 – Allowances.

3.7 FIELD PAINTING

.1 Paint in accordance with Section 09 91 10 - Painting.

.1 Touch up damaged surfaces and surfaces without shop coat with primer to SSPC-SP7 except as specified otherwise. Apply in accordance: MPI Architectural Painting Specification Manual.

3.8 CLEANING

.1 Clean in accordance with Section 01 74 00 – Cleaning and Waste Management.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A653/A653M – Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

.2 ASTM A792/A792M – Specification for Steel Sheet, 55%Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181 – Ready-Mixed Organic Zinc-Rich Coating

.3 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.79 – Cellular Metal and Cellular Concrete Floor Raceways and Fittings

.2 CAN/CSA-S16 – Design of Steel Structures

.3 CSA-S136 – Cold Formed Steel Structural Members

.4 CSA W47.1 – Certification of Companies for Fusion Welding of Steel Structures

.5 CSA W55.3 – Certification of Companies for Resistance Welding of Steel and Aluminum

.6 CSA W59 – Welded Steel Construction (Metal Arc Welding)

.4 Canadian Sheet Steel Building Institute (CSSBI)

.1 CSSBI 10M – Standard for Steel Roof Deck

.2 CSSBI 12M – Standard for Composite Steel Deck

1.2 DESIGN REQUIREMENTS

.1 Design steel deck using limit states design in accordance with CSA S136.

.2 Steel deck and connections to steel framing to carry dead, live and other loads including lateral loads, diaphragm action, composite deck action, and uplift as indicated.

.3 Deflection under specified live load not to exceed 1/360 of span.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit shop drawings erection and shoring drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit drawings stamped and signed by qualified professional engineer registered or licensed in the Province of Manitoba, Canada.

.3 Submit design calculations if requested by Contract Administrator.

.4 Indicate deck plan, profile, dimensions, base steel thickness, metallic coating designation, connections to supports and spacings, projections, openings, reinforcement details and accessories.

.5 Indicate details of temporary shoring of steel deck, such as location, time and duration of placement and removal of shoring for concrete fill decks.

Part 2 Products

2.1 MATERIALS

.1 Zinc-iron Alloy (ZF) coated steel sheet: to ASTM A653/A653M structural quality Grade 230, with ZF75 coating, for interior surfaces not exposed to weather, unpainted finish, thickness as indicated on structural drawings.

.2 Decks to be painted: zinc-iron alloy coated decks suitable for finish painting.

.3 Zinc (Z) coated steel sheet: to ASTM A653/A653M structural quality Grade 230, with ZF75, coating, for exterior surfaces exposed to weather, thickness as indicated on structural drawings.

.4 Acoustic insulation: fibrous glass 17.5 kg/m^3 density profiled to suit deck flutes.

.5 Closures: as indicated in accordance with manufacturer's recommendations.

.6 Cover plates, cell closures and flashings: steel sheet with minimum base steel thickness of 0.76 mm. Metallic coating same as deck material.

.7 Primer: zinc rich, ready mix to CAN/CGSB-1.181.

2.2 TYPES OF DECKING

.1 Composite steel floor deck: thickness and profile as per structural drawings, interlocking side laps.

Part 3 Execution

3.1 GENERAL

.1 Structural steel work: in accordance with CAN/CSA-S136.

.2 Welding: in accordance with CSA W59, except where specified otherwise.

.3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel and/or CSA W55.3 for resistance welding.

3.2 ERECTION

.1 Erect steel deck as indicated and in accordance with CSA S136, and in accordance with reviewed erection drawings.

.2 Butt ends: to 1.5 to 3mm gap. Install steel cover plates over gaps wider than 3 mm.

.3 Lap ends: to 50mm minimum.

.4 Immediately after deck is permanently secured in place, touch up metallic coated top surface with compatible primer where burned by welding.

.5 Prior to concrete placement, steel deck to be free of soil, debris, standing water, loose mil scale and other foreign matter.

.6 Temporary shoring, if required, to be designed to support construction loads, wet concrete and other construction equipment. Do not remove temporary shoring until concrete attains 75% of its specified 28 day compression strength.

.7 Place and support reinforcing steel as indicated.

3.3 CLOSURES

.1 Install closures in accordance with approved details.

3.4 OPENINGS AND AREAS OF CONCENTRATED LOADS

.1 No reinforcement required for openings cut in deck which are smaller than 150mm square.

.2 Frame deck openings with any one dimension between 150 to 300mm as with minimum L64x64x6.4 each side of opening perpendicular to flutes. Angle shall be welded to at least two (2) flutes on each side of opening.

.3 Deck supplier shall reinforce openings over 300mm to 450mm across the flutes with suitable reinforcement based on a structural analysis of the loads involved.

.4 For deck openings with any one dimension greater than 450mm and for areas of concentrated load, reinforce in accordance with structural framing details, except as otherwise indicated.

3.5 CONNECTIONS

.1 Install connections in accordance with CSSBI recommendations as indicated.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM)

- .1 ASTM A53/A53M – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
- .2 ASTM A269 – Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
- .3 ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-1.40 – Anticorrosive Structural Steel Alkyd Primer
- .2 CAN/CGSB-1.181 – Ready-Mixed Organic Zinc-Rich Coating

.3 Canadian Standards Association (CSA)

- .1 CSA G40.20/G40.21 – General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel
- .2 CAN/CSA G164 – Hot-Dip Galvanizing of Irregularly Shaped Articles
- .3 CSA S16 – Design of Steel Structures
- .4 CSA W59 – Welded Steel Construction (Metal Arc Welding)

.4 Steel Structures Painting Council (SSPC)

- .1 SSPC Standards

1.2 QUALITY ASSURANCE

.1 Design stairs, balustrades, landings and connections to MBC vertical and horizontal live load requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit shop drawings clearly indicating materials, core thickness, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

.3 Shop drawings for stair and fabricator designed assemblies shall bear the seal and signature of a qualified professional engineer registered in the Province of Manitoba.

Part 2 Products

2.1 MATERIALS

.1 Steel sections and plates: to CSA G40.20/G40.21, Type 300 W for steel sections, Type 260 W for steel plate.

.2 Steel pipe: to ASTM A53/A53M, standard weight, black or galvanized finish.

.3 Stainless steel: to ASTM A269, Type 304, exposed surfaces to have No. 4 polished finish.

.4 Welding: to CSA W59, unless otherwise noted.

.5 Bolts and anchor bolts: to ASTM A307.

.6 Galvanizing: hot dipped galvanizing with minimum zinc coating of 2 oz/ft^2 to CAN/CSA G164.

.7 Shop coat primer: to CAN/CGSB-1.40.

.8 Galvanized primer: zinc rich, ready mix to CAN/CGSB-1.181.

.9 Sulphur: commercial grade for setting metal posts.

2.2 FABRICATION

.1 Review Contract Documents and provide all metal fabrications indicated.

.2 Notify Contract Administrator of any proposed member substitutions and changed connection details.

.3 Fabricate work square, true, straight, and accurate, to required size, with joints closely fitted and properly secured.

.4 Fabricate items from steel unless otherwise noted.

.5 Verify all dimensions prior to fabrication.

.6 Provide bolt holes where required for fastenings.

.7 Use self-tapping shake-proof, countersunk, flat-headed screws on items required to be assembled by screws or as indicated.

.8 Where possible, Work to be fitted and shop assembled, ready for erection.

.9 Exposed welds to be continuous for length of each joint, filed or ground smooth, and flush.

.10 Supply all items for building-in in ample time for incorporation into the Work without delay to other trades.

2.3 SHOP PAINTING

.1 Clean surfaces in accordance with Steel Structures Painting Council (SSPC) standards.

.2 Apply one (1) shop coat of primer to metal items, with exception of stainless steel, aluminum, and those to be galvanized or encased in concrete (interior of stair pans).

.3 Apply two (2) coats of primer in different colours to parts inaccessible after final assembly.

.4 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, and grease. Do not paint when temperature is lower than 7°C.

.5 Clean surfaces to be field welded. Do not paint.

2.4 MISCELLANEOUS STEEL BRACKETS, ANCHOR BOLTS, SUPPORTS AND ANGLES

.1 Supply for installation, steel brackets, supports, anchor bolts and angles as indicated. Drill for countersunk screws and anchor bolts.

2.5 STEEL LINTELS

.1 Loose steel lintels of sizes indicated, for openings in masonry walls unless otherwise noted. Prime paint.

.2 Provide 200mm (8”) minimum bearing at ends. Weld or bolt together angles where installed back-to-back. Refer to structural.

.3 Fabrication of steel lintels shall be in accordance with the requirements of Section 05 12 00, Structural Steel, and CSA S16.

2.6 STAINLESS STEEL HANDRAILS (EXIST STAIR S01)

.1 Continuous Schedule 40 stainless steel pipe handrails, bent brackets and verticals with base plate, as detailed on AS-5.

.2 All joints welded, ground, blended and polished.

.3 Cap and weld exposed ends of handrails.

2.7 NEW INTERIOR STAIRS (STAIR S02)

.1 Fabricate stairs with closed riser steel pan construction as detailed.

.2 Form treads and risers from 3mm (1/8”) thick steel plate. Secure treads and risers to L35 x 35 x 5mm (L1-2/5” x 1-2/5” x 1/5”) horizontal and vertical cleats welded to stringers.

.3 Form stringers from MC310 x 15.8mm (12” x 5/8”), outer stringers with 6mm (1/4”) thick plate fascia welded on. Extend stringers around mid landings to form steel base. Close ends of stringers where exposed.

.4 Weld connections where possible, otherwise bolt connections. Countersink exposed fastenings, cut off bolts flush with nuts. Make exposed connections of same material, colour, and finish, as base material on which they occur.

.5 Accurately form connections with exposed faces flush; mitres and joints tight. Make risers of equal height.

.6 All steel stair components, including stringers, risers, landings, treads, etc. shall be ready for paint finish.

.7 Handrails:

.1 Wall handrails: continuous steel pipe wall handrails and brackets to spec detail 5.6, half-round ends, powder coat paint finish.

.2 Handrails and guardrails: continuous steel pipe handrails, posts and pickets as detailed, powder coat paint finish.

.3 Cap and weld exposed ends of handrails.

.4 Weld balustrades to stringers as indicated.

2.8 WALL HANDRAILS (EXIST STAIR S03)

.1 Wall handrails: continuous steel pipe wall handrails and brackets to spec detail 5.6, half-round ends, ready for paint finish.

2.9 NEW HANDRAILS AND STRINGERS (EXIST STAIR S04)

.1 Risers: new 6mm (1/4”) thick steel plate closed risers between existing open pan treads, ready for paint finish.

.2 Handrails:

.1 Wall handrails: continuous steel pipe wall handrails and brackets to spec detail 5.6, half-round ends, powder coat paint finish.

.2 Handrails and guardrails: continuous steel pipe handrails, posts and pickets as detailed, powder coat paint finish.

.3 Cap and weld exposed ends of handrails.

2.10 EXTERIOR STAIR HANDRAILS

.1 Galvanized standard pipe railings and balusters with solid steel pickets and bar railings, ready for paint finish. Cap and weld exposed ends of handrails. Refer to details.

2.11 ACCESS LADDERS

.1 Steel access ladder to roof/attic space complete with safety cage and lockable cover plate as detailed, ready for paint finish.

2.12 SUMP COVER

.1 Galvanized steel checker-plate cover to suit sump pit, 9mm (3/8”) thick with bent steel bar handle, complete with angle frame as detailed on spec detail 5.5. Provide continuous bead of sealant as detailed.

2.13 REFUSE BIN ENCLOSURE

.1 Galvanized HSS posts, steel channels, steel base plates and hardware as detailed on AS-7.1 and AS-7.2.

Part 3 Execution

3.1 ERECTION

.1 Erect metalwork square, plumb, straight, and true, accurately fitted with tight joints and intersections, as indicated.

.2 Erect loose steel lintels in accordance with drawings and as recommended by CSA S16.

.3 Provide suitable means of anchorage, acceptable to the Contract Administrator, such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.4 Make field connections with high tensile bolts to CSA S16, or weld.

.5 Hand items to be cast into concrete or built into masonry over to appropriate trades together with setting templates.

.6 Touch up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with suitable primer.

.7 Touch-up galvanized surfaces with zinc primer where burned by field welding.

.8 Leave all surfaces in clean condition, free of foreign substances, ready for finish painting where required.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA)

- .1 CSA B111 – Wire Nails, Spikes and Staples
- .2 CAN/CSA G164 – Hot Dip Galvanizing of Irregularly Shaped Articles
- .3 CSA-O80 Series – Wood Preservation
- .4 CSA O86.1 – Engineering Design in Wood
- .5 CSA O121 – Douglas Fir Plywood
- .6 CSA O141 – Softwood Lumber
- .7 CSA O151 – Canadian Softwood Plywood

.2 Manitoba Building Code (MBC)

.3 National Lumber Grades Authority (NLGA)

- .1 Standard Grading Rules for Canadian Lumber

1.2 SOURCE QUALITY

.1 Identify lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Identify plywood by grade mark in accordance with applicable CSA standards.

Part 2 PRODUCTS

2.1 LUMBER MATERIALS

.1 Except as indicated or specified otherwise, lumber shall be softwood, S4S, moisture content (M.C.) not greater than 19% at time of installation, in accordance with the following standards:

- .1 CSA O141
- .2 NLGA Standard Grading Rules for Canadian Lumber

.2 Fire-retardant treated wood:

- .1 Pressure treat wood with fire-retardant chemical, according to CSA-O80.20. Follow-up inspection and labeling shall be provided by Underwriters' Laboratories of Canada (ULC) and material shall be certified to have the following:
  - .1 Flame spread rating: 25 or less
  - .2 Fuel contribution: 25 or less
  - .3 Smoke development: 25 or less

.2 All material shall be kiln dried to 19% after pressure impregnation. Treated lumber shall remain dry (below fibre saturation) in relative humidity exposures up to 95%.

.3 Fire-retardant chemical used for treatment shall be free of halogens, sulphates, ammonium phosphates and formaldehyde.

.3 Machine stress-rated lumber is acceptable for all purposes.

.4 Glued end-jointed (finger-jointed) lumber is not acceptable.

.5 Framing and board lumber: minimum requirements in accordance with MBC Table 9.23.10.A, unless noted otherwise. Stud wall framing: SPF species, NLGA Standard stud No. 2 grade, S4S, 15% M.C., or as indicated on structural drawings.

.6 Spanning members: minimum requirements in accordance with MBC 9.23.4, unless noted otherwise:

.1 Use S4S material

.2 Dimension sizes: SPF species, NGLA #2 grade, S4S, 19% M.C.

.7 Board lumber, furring, blocking, strapping, nailing strips, grounds, rough bucks, cants, curbs, and nailers:

.1 Use S4S material

.2 Board sizes: SPF species, NLGA #2 construction grade

.3 Dimension sizes: SPF species, NLGA #2 construction grade

.4 Post and timber sizes: “standard” or better grade.

.5 All exterior wall rough bucks to be pressure treated. Roof blocking, cants and curbs shall be pressure treated where noted.

2.2 PANEL MATERIAL

.1 Panel material shall be of type, grade and thickness as indicated, and in accordance with the following standards:

.1 Douglas Fir Plywood (DFP): to CSA O121

.2 Canadian Softwood Plywood (CSP): to CSA O151

.2 Except as specified otherwise, panels shall be minimum 1200mm x 2400mm (4ft x 8ft) size, square edge.

.3 Sub-flooring: plywood, exterior type, DFP or CSP, standard sheathing grade, T&G long edge, thickness as indicated on drawings.

.4 Underlay: plywood, CSP sheathing grade face veneer, or DFP underlayment grade, face of veneer, sanded one (1) side.

2.3 FASTENINGS AND HARDWARE

.1 Fastenings and hardware shall comply with Part 9 of MBC as supplemented by following requirements, except where specific type is indicated.

.2 Nails, spikes and staples to CSA B111, minimum requirements to MBC 9.23.3 except:

.1 Use common wire nails, except where indicated otherwise.

.2 Use hot-dip galvanized finish steel to CSA G164 for exterior Work, interior highly humid areas and for pressure-preservative treated lumber, except where indicated otherwise.

.3 Use primer paint finish where installed on site-exposed surfaces.

.4 Bolts to be minimum 13mm (1/2”) unless noted otherwise.

.3 Use surface fastenings of following types, except where specific type is indicated:

.1 To hollow masonry, plaster and panel surfaces use toggle bolts.

.2 To solid masonry and concrete, use expansion shields with lag screws, jute fibre or lead plugs with wood screws.

.3 To structural steel, use bolts through power driven self-drilling screws, or welded stud-bolts, or explosive actuated stud-bolts.

.4 Garbage bin enclosure hardware:

.1 Casters: heavy-duty rubber locking swivel casters.

2.4 WOOD PRESERVATIVES

.1 Surface-applied wood preservative: copper napthenate or pentachlorophenol base, water-repellent wood preservative, clear at exposed locations.

2.5 PRESERVATIVE TREATED LUMBER

.1 Material shall be treated to CSA-O80 Series using water-borne preservative to obtain minimum net retention as recommended by the Commodity Standards CSA-O80 Series to CSA-O80.30 inclusive, as appropriate to end use.

.2 Following water-borne preservative treatment, dry material to maximum moisture content of 19%.

2.6 SEALANTS

.1 Sealants to Section 07 92 00, Joint Sealants.

.2 Sill plate gasket: 6mm (1/4") thick polyethylene foam, width as indicated.

.1 Standard of acceptance:

.1 Owens Corning FoamSealR Sill Gasket

.2 Protecto Wrap Energy Plate Liner

.3 Or approved equal

Part 3 EXECUTION

3.1 ERECTION OF FRAMING MEMBERS

.1 Install members true to line levels and elevations. Space uniformly.

.2 Construct continuous members from pieces of longest practical length.

.3 Install spanning members with "crown-edge" up.

3.2 FURRING AND BLOCKING

.1 Install furring and blocking as required to space out and support surface applied cabinets and other Work as indicated.

.2 Refer to the finish hardware, and provide blocking to support wall stops, where required.

.3 Align and plumb faces of furring and blocking to tolerance of 1:600.

3.3 ROUGH BUCKS AND NAILERS

.1 Install wood bucks and nailers as indicated including:

.1 Wood bucks and linings around frames for doors and windows.

.2 Except where indicated otherwise, use material at least 13mm (1/2”) thick secured with 10mm (3/8”) bolts located within 300mm (12”) from ends of members and uniformly spaced at 1200mm (4ft) on centre.

3.4 ROOF FASCIAS, CANTS, NAILERS, AND CURBS

.1 Install blocking, nailers, curbs, and other wood supports for roofing and sheet metal Work, and roof-mounted equipment as indicated.

.2 Secure with galvanized 10mm (3/8”) bolts where indicated, galvanized nails elsewhere. Locate fastenings within 300mm (12”) from ends and uniformly spaced between. Space bolts at 1200mm (4ft) and nails at 600mm (24”) centres maximum, except where indicated otherwise.

3.5 FASTENERS

.1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.2 Countersink bolts where necessary to provide clearance for other Work.

.3 Use nailing disks for soft sheathing as recommended by sheathing manufacturer.

3.6 SURFACE-APPLIED WOOD PRESERVATIVES

.1 Treat surfaces of material with wood preservative, before installation. Wherever possible apply preservative after materials have been cut and fit to size.

.2 Apply preservative by dipping, or by brush or spray to completely saturated and maintain wet film on surface for minimum three (3) minute soak on lumber and one (1) minute soak on plywood.

.3 Re-treat surfaces exposed by cutting, trimming or boring, with liberal brush application of preservative before installation.

.4 Treat all material in the building envelope, and material exposed to weather, including wood cants, fascia backing, curbs, nailers, etc.

3.7 ELECTRICAL EQUIPMENT BACKBOARD

.1 Provide backboards for mounting electrical equipment as indicated. Use 19mm (3/4”) thick fire-retardant treated plywood on 19mm x 38mm (3/4” x 1-1/2”) furring around perimeter and at maximum 300mm (12”) intermediate spacing.

END OF SECTION

Part 1 GENERAL

1.1 QUALITY ASSURANCE STANDARDS

.1 The "Quality Standards" of the Architectural Woodwork Manufacturer's Association of Canada (AWMAC), Current Edition, together with authorized additions and amendments, shall be used as a reference standard and shall form part of this project specification.

.2 Where modifications to the AWMAC Quality Standards contained within the Manual are included in this project specification, then such modifications shall govern in case of conflict.

.3 Any reference to Custom or Premium grade in this specification shall be as defined in the AWMAC Quality Standards.

.4 For doors, Custom or Premium grades in this specification shall be as defined in the AWMAC Quality Standards.

.5 Any item not given a specific quality grade shall be Custom grade as defined in the manual.

.6 Maintain a copy of the AWMAC Quality Standards, to be made readily available for reference purposes.

.7 Woodwork manufacturer qualifications: registered member in Good Standing with AWMAC.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide in accordance with Section 01 33 00, Submittal Procedures.

.2 Shop drawings:

.1 Shop drawings shall show construction details of all architectural woodwork, general arrangements, locations of all service outlets, etc., typical and specific installation conditions; the material being supplied and all connections, attachments, anchorage and location of exposed fastenings, as applicable.

.2 Shop drawings shall incorporate plans, elevations, sections and details for all Work included in this Section, and the details shall show and specify all thicknesses, types and finishes, and all hardware.

.3 No Work shall be fabricated until the shop drawings and all other related submittals, documentation and samples, as required by the specifications, have been reviewed by the Contract Administrator.

1.3 PRODUCT STORAGE AND HANDLING

.1 The fabricator and the Contractor shall be jointly responsible to make certain that architectural woodwork is not delivered until the building and storage areas are sufficiently dry so that the woodwork will not be damaged by excessive changes in moisture content.

.2 Product delivery, storage and handling shall be in accordance with Section 1700, of the AWMAC Quality Standards.

.3 Delivered materials which are damaged in any way or do not comply with these specifications be rejected by the Contract Administrator and shall be removed from the job site and replaced with acceptable materials.

Part 2 PRODUCTS

2.1 GENERAL

.1 Use clean stock only and comply with AWMAC Quality Standards for following grades.

.2 Note on drawings where word "natural" or its abbreviation "nat" is used, this shall mean for transparent finish.

2.2 EXISTING TRIM

.1 Existing chair rail, wainscotting, baseboards and trim to remain: protect and prepare for new paint finish.

.2 Existing chair rail, wainscotting, baseboards and trim to be removed and replaced: salvage existing as required and protect until reinstallation. Strip and prepare for new paint finish.

2.3 WOOD TRIM

.1 New wood trim, base and casings to match existing: where noted on drawings, provide new wood trim, base and casings to match existing profiles, ready for finish as noted.

2.4 WOOD DOORS

.1 Flush, AWMAC Custom grade, solid core, 44mm (1-3/4”) thick, for paint finish. Adjacent members shall be compatible for colour.

.2 Glass: refer to Section 08 80 00, Glazing.

2.5 HARDWARE

.1 Door hardware: refer to Section 08 71 00, Finish Hardware.

2.6 WALL PANELS / TRANSOM INFILL

.1 Thermally fused laminate (TFL) wall panels complete with PVC edges on plywood backer as detailed on drawings. Refer to Section 06 41 00 – Custom Casework for TFL.

Part 3 EXECUTION

3.1 JOB CONDITIONS

.1 Job conditions for installation of architectural woodwork shall be as specified under Section 1700 of the AWMAC Quality Standards.

3.2 INSTALLATION

.1 Installation shall be in accordance with Section 1700 of the AWMAC Quality Standards.

END OF SECTION

Part 1 GENERAL

1.1 FITTED FOR, BUT INSTALLED BY OTHERS

.1 Faucets, tail strainers, traps, interconnecting piping, conduits, electrical outlets, non-integral sinks and drains.

1.2 QUALITY ASSURANCE STANDARDS

.1 The “Quality Standards” of the Architectural Woodwork Manufacturers Association of Canada (AWMAC), Current Edition, together with authorized additions and amendments, shall be used as a reference standard and shall form part of this project specification.

.2 Where modifications to the AWMAC Quality Standards contained within the Manual are included in this project specification, then such modifications shall govern in case of conflict.

.3 Any reference to Custom or Premium grades in this specification shall be as defined in the AWMAC Quality Standards.

.4 Any item not given a specific quality grade shall be Custom grade as defined in the manual.

.5 Maintain a copy of the AWMAC Quality Standards, to be made readily available for reference purposes.

.6 Woodwork manufacturer qualifications: registered member in Good Standing with AWMAC.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit shop drawings and samples in accordance with Section 01 33 00, Submittal Procedures.

.2 Submit shop drawings indicating:

- .1 Details of construction, profiles, jointing, fastening and other related details with sections
- .2 Locations of each unit
- .3 Locations for roughing-in of plumbing and electrical
- .4 Finish material and thicknesses
- .5 Location of locks as required

.3 Samples:

- .1 Submit for examination at suitable location, one (1) base cabinet complete with cupboard door and drawers minimum 750mm (30") long, including counter top, splash back.

.2 Submit for examination at suitable location one (1) upper wall cupboard minimum 750mm (30") long.

.3 Submit 300mm (12") long samples of other materials, hardware and fittings not included with .1 and .2 above.

.4 Samples may form part of completed work as permitted by Contract Administrator, upon written request from the Contractor.

1.4 PRODUCT STORAGE AND HANDLING

.1 The fabricator and the Contractor shall be jointly responsible to make certain that custom casework is not delivered until the building and storage areas are sufficiently dry so that the woodwork will not be damaged by excessive changes in moisture content.

.2 Product delivery, storage and handling shall be in accordance with Section 1700, of the AWMAC Quality Standards.

.3 Delivered materials which are damaged in any way or do not comply with these specifications be rejected by the Contract Administrator and shall be removed from the job site and replaced with acceptable materials.

1.5 MAINTENANCE DATA

.1 Provide maintenance data, parts list, and manufacturer's instructions for each type of hardware.

.2 Provide maintenance data regarding proper care, cleaning and general maintenance.

Part 2 PRODUCTS

2.1 GENERAL

.1 Use clean stock only and comply with AWMAC Quality Standards grades specified.

2.2 CASEWORK

.1 AWMAC Quality Grade: Custom where applicable.

.2 Construction: Flush overlay.

.3 Bodies, including ends, divisions, gables, fixed shelves, bottoms and tops, shall be General Purpose (GP) plastic laminate on 19mm (3/4") plywood, all exposed edges shall be matching colour PVC, 3mm thick, unless noted otherwise.

.4 Use solid wood or veneer core softwood plywood for all kickboards and base components in contact with floor.

.5 Backs: 13mm (1/2") thermally fused laminate (TFL) set into case body 16mm (5/8"), or 6mm (1/4") prefinished hardboard with screw strips (hardboard colour to match body).

.6 Shelves: GP plastic laminate on 19mm (3/4”) plywood, except where unsupported for more than 914mm (36") and up to 1066mm (42") in length shall be at least 25mm (1") thick, or have stiffening edge of 19mm (3/4”). Edge with 3mm PVC. Edge all around adjustable shelves.

.7 Wood veneer and trim, where noted: rift cut red oak veneer and solid red oak, thicknesses as noted, ready for stain finish.

.8 Metal accent strips: Formica DecoMetals, or approved equal. Contract Administrator to select from “Wax Rubbed Brass”, “Oil Rubbed Brass”, or “Brushed Brass”.

.9 Holes drilled in gables with metal or plastic shelf supports may be provided in lieu of pilaster strips.

.10 Drawers: form box of 13mm (1/2") TFL material including sub-front and bottom. Alternatively front fixed to sides using dovetail joint. Edge top edges with 3mm PVC.

.11 Door and drawer fronts: GP plastic laminate, both faces of 19mm (3/4”) plywood, with 3mm PVC edge all around.

.12 Glass: refer to Section 08 80 00 – Glazing.

2.3 COUNTERTOPS, BACKSPLASHES AND SILLS

.1 Refer to Section 06 61 16 – Solid Surfacing Fabrications.

2.4 PLASTIC LAMINATE COLOURS

.1 For GP plastic laminate, Contract Administrator to select from standard range of solid colours, patterns and simulated wood grains from Nevamar (textured "T" finish) including "Hallmark Series", up to 6 (six) colours per project. Pionite Standard series, standard finish including all solids and patterns, as distributed by Marco Component Products is acceptable “as Equal”. WilsonArt (textured finish), Forbo-Arborite (suede "S" finish) or Formica (velour's or matte finish), may be Bid as Alternates.

2.5 THERMALLY FUSED LAMINATE COLOURS

.1 Standard of acceptance:

.1 Contract Administrator to select from **ALL** price groups, series, collections, colours and textures from Tafisa Decorative Panels (TFL) as distributed by White-Wood Group.

.2 Approved equal:

.1 **ALL** price groups, series, collections, colours and/or textures from Wilsonart TFL as distributed by McKillican Canadian, Uniboard as distributed by Hardwoods Inc., Stevens Wood TFL as distributed by Robert Bury & Co., and Prism TFL as distributed by Formations Wood.

2.6 UPHOLSTERED BENCH

.1 Seat fabric, standard of acceptance: “Clean Vinyl Textiles” collection, as manufactured and distributed by Momentum Textiles and Wallcovering. 100% clean vinyl, phthalate free, polyester backing, finished with protective topcoat, 54” wide.

.2 Plywood base and steel framing: as detailed on AS-6.

2.7 CASEWORK HARDWARE

.1 Hinges: 170 degree, self-closing, soft-close, all metal concealed hinge, finish to be selected by Contract Administrator.

.1 Acceptable manufacturers: Blum, Salice, Mepla, Hafele, or approved equal.

.2 Pulls:

.1 Typical: Hafele Canada, “Elite Handle, Zinc”, Art. no. 111.95.306, colour: black, 128mm c.c., 150mm x 27mm overall, supplied with 25mm screws, or approved equal.

.2 For use with AS-3 and AS-4 series millwork: Hafele Canada, design model H1970, bronzed and brushed, Art. no. 106.69.000, zinc alloy, 170mm total length, 128mm and 160mm c.c., 16mm width, 25mm projection, or approved equal.

.3 Drawer slides: soft-close, concealed undermount slides, 100 lb (45kg) load capacity, length as required. Standard of acceptance: Richelieu 838 Series, or approved equal.

.4 Adjustable shelf supports: KV255 pilaster strips and KV256 supports, epoxy coated, colour to match cabinet body (white or almond), or approved equal. Acceptable equal: "REHAU" 634580 and 254920 pilaster strips and supports.

.5 Door catches: for doors paired with locked doors use Amerock 3675 E-Z Flex Elbow Catch, or approved equal.

.6 Bumper pads: clear, self-adhesive type, 8mm (5/16") diameter. Provide two (2) per door and drawer.

.7 Locks: CCL cabinet lock 02066 x 26D for drawer, 02067 x 26D for door or similar. Keyed alike or differently as required. Provide each lock with two (2) keys. 180 key changes. All millwork doors and drawers shall be lockable.

.8 Gate hardware: Richelieu model 810FBB, Onward Double Action Spring Hinge, 3-3/4", colour: black, or approved equal.

.9 Electric cord desk receptacle (for hole through counter top): colour: black, two-piece.

.10 Under-counter support brackets: Richelieu SpeedBrace Countertop Brace, or approved equal, 12 gauge steel, colour to be selected by Contract Administrator.

.11 Lateral file storage: as detailed on AS-3.8.

.12 Display case hardware: as noted on AS-4.9.

.13 LED light strip: refer to Electrical.

Part 3 EXECUTION

3.1 JOB CONDITIONS

.1 Job conditions for installation of architectural woodwork shall be as specified under Section 1700 of the AWMAC Quality Standards.

3.2 INSTALLATION

.1 Cabinet and casework: Install in accordance with Section 1700 of the AWMAC Quality Standards. Use draw-bolts and spines in countertop joints.

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product data:

.1 Submit manufacturer's literature and data sheets for each type of material provided.

.2 Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions.

.3 Shop drawings:

.1 Indicate material characteristics, details of construction, connections and relationship with adjacent construction.

.2 Indicate plans, sections, dimensions, component sizes, edge details, fabrication details, attachment provisions, sizes of furring, blocking including concealed blocking, and coordination requirements with adjacent work.

.3 Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacles and other items installed in solid polymer fabrications.

.4 Coordination drawings: submit coordination drawings indicating plumbing and miscellaneous steel work indicating locations of wall (rated or non-rated), blocking requirements, recessed wall items and similar items.

.5 Field measurements: take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting of work. Do not fabricate work unless shop drawings have been reviewed.

.6 Samples: submit duplicate 300mm x 300mm sample of each colour, texture, size, and pattern of solid surfaces.

1.2 CLOSEOUT SUBMITTALS

.1 Provide maintenance data including repair and maintenance instructions for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

.2 Provide adequate warning of maintenance practices or cleaning agents detrimental to specified material.

1.3 QUALITY ASSURANCE

.1 Installer qualifications: manufacturer approved installer shall fabricate and install solid surface products, and demonstrate successful experience in installing finished carpentry items similar in type and quality to those required for this project.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements and with manufacturer's written instructions.

.2 Deliver sheets, fabricated items, materials and components in manufacturer’s original, unopened, undamaged containers with identification labels intact.

.3 Store products and accessories as recommended by manufacturer.

1.1 ENVIRONMENTAL CONDITIONS

.1 Maintain air temperature and structural base temperature at granite installation area above 12 degrees C for 48 hours before, during, and 48 hours after, installation.

.2 Do not install solid surface products at temperatures less than 12 degrees C or above 38 degrees C.

.3 Do not apply epoxy mortar and grouts at temperatures below 15 degrees C or above 25 degrees C.

Part 2 Products

2.1 MATERIALS

.1 Non-porous, homogeneous material maintaining the same composition throughout the product with a composition of polyester or acrylic polymer, aluminum trihydrate filler and pigment, with the following characteristics:

.1 Sheet thickness: as indicated on drawings.

.2 Edge treatment: as indicated on drawings.

.3 Sink mounting: as indicated on reviewed shop drawings.

.4 Mounting adhesive: mildew-resistant, FDA-compliant, 100% silicone sealant recommended by manufacturer.

.5 Field joints: shall be hard seamed unless otherwise specified.

.6 Colours: to be selected from manufacturer’s full range.

.7 Acceptable products:

.1 Reception desk and typical millwork: Wilsonart Solid Surface

.2 Radiation chase and window sills: Corian Solid Surface

.3 Or approved equal

2.2 MORTAR AND ADHESIVE MATERIALS

.1 Dry set or thin set mortar: mix to manufacturer's instructions.

.2 Acrylic adhesive compatible to solid surfacing and substrate.

2.3 ACCESSORIES

.1 Sealer and protective coating: to manufacturer’s recommendations.

Part 3 Execution

3.1 EXAMINATION

.1 Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of Work. Proceed with installation only after unsatisfactory conditions have been corrected.

.2 Site verification of conditions: verify actual site dimensions and location of adjacent materials prior to commencing Work.

.3 Examine cabinets upon which countertops are to be installed. Verify cabinets are level to within 3mm in 3m (1/8" in 10ft).

.4 Notify Contract Administrator in writing of any conditions which would be detrimental to installation. Commencement of Work implies acceptance of previously completed Work.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.3 INSTALLATION

.1 Install components plumb, level, rigid, scribed to adjacent finishes in accordance with reviewed shop drawings and product installation details.

.2 Route radii and contours to template. Anchor securely to base component or other supports. Align adjacent components and form seams to comply with manufacturer’s written recommendations using adhesive in color to match Work. Carefully dress joints smooth, remove surface scratches and clean entire surface.

.3 Install countertops with no more than 3mm (1/8") sag, bow or other variation from a straight line.

.4 Mount sinks/bowls to countertops using manufacturer's recommended adhesive, mounting hardware or color-matched silicone sealant as applicable. Secure seam mounted bowls and sinks to countertops using colour matched joint adhesive

.5 Seal joints between wall and components with joint sealant as specified herein and in Section 07 92 00 - Joint Sealants, as applicable.

.6 Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Ensure components are clean and free of defects at Substantial Performance of The Work.

.7 Coordinate connections of plumbing fixtures and ensure fittings and accessories are provided by mechanical.

3.4 SEALER AND PROTECTIVE COATING

.1 Apply in accordance with manufacturer's instructions.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society of Testing and Materials (ASTM)

- .1 ASTM C423 – Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
- .2 ASTM C665 – Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
- .3 ASTM C1320 – Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction

.2 Underwriters Laboratories of Canada (ULC)

- .1 ULC 114 – Standard Method of Test for Determination of Non-Combustibility in Building Materials
- .2 ULC 702 – Standard for Thermal Insulation, Mineral Fibre, for Buildings
- .3 ULC 702 – Standard for Mineral Fibre Insulation for Buildings

1.2 DELIVERY, STORAGE, AND HANDLING

.1 Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources.

.2 Store inside and in a dry location.

.3 Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

Part 2 PRODUCTS

2.1 MINERAL WOOL BLANKET INSULATION

.1 Batt and blanket mineral fibre: to ULC 702.

- .1 Type: 1
- .2 Unfaced
- .3 Thickness: friction fit, full depth of stud cavity or as indicated.
- .4 Fire resistance: to ULC 102.
  - .1 Flame spread index: 0.
  - .2 Smoke developed index: 0.
- .5 Non-combustible in accordance with ULC 114.

.6 Acceptable manufacturers:

.1 Rockwool

.2 Owens Corning

.3 CertainTEED

.4 or approved equal

2.2 MINERAL WOOL ACOUSTIC INSULATION

.1 Batt and blanket mineral fibre: to ASTM C665 and ULC 702.

.1 Type: 1

.2 Thickness: to fill cavity thickness, and as required to reach STC 50, unless otherwise noted.

.3 Fire resistance: to ASTM E84 and ULC 102.

.1 Flame spread index: 0.

.2 Smoke developed index: 0.

.4 Non-combustible in accordance with ULC 114.

.5 Smoulder resistance: 0.09% in accordance with ULC 129.

.6 System testing: refer to wall types for STC rating requirements.

.7 Acoustic performance: to ASTM C423.

.8 Acceptable manufacturer:

.1 Rockwool

.2 Owens Corning

.3 CertainTEED

.4 or approved equal

2.3 ACCESSORIES

.1 Mechanical fasteners: in accordance with manufacturer's written instructions.

.2 Wire mesh: as required to support insulation within wall cavities larger than required insulation depth.

.3 Tape: as recommended by manufacturer.

Part 3 EXECUTION

3.1 BATT INSULATION INSTALLATION

.1 Install insulation to maintain continuity of thermal protection to building elements and spaces and to ASTM C1320.

.2 Install insulation to maintain continuity of fire and sound protection to building elements and spaces and to ASTM C1320.

.3 Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

.4 Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavities, provide lengths that will produce snug fit between ends.

.5 Place insulation in cavities formed by framing members to produce friction fit between edges of insulation and adjoining framing members.

.6 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

.7 Maintain 75mm clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

.8 Do not compress insulation excessively to fit into spaces.

3.2 ACOUSTIC TREATMENT

.1 Install acoustic insulation between studs in sound rated partitions.

.2 Coordinate installation of acoustic batt insulation with other work.

.3 Ensure sound attenuation blankets fill space between studs run continuously from floor to ceiling of structure, over door frames and openings and around corners.

.4 Ensure insulation is packed around cut openings in wallboard, behind outlet boxes, around plumbing, heating or structural items passing through the system and at abutting walls.

.5 Refer to Section 09 21 16 - Gypsum Board, for application of acoustical sealant to sound rated partitions.

3.3 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Underwriters' Laboratories of Canada (ULC)

.1 ULC 705.1 – Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Material Specification

.2 ULC 705.2 – Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Application

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product data: for each type of product indicated.

1.3 QUALITY ASSURANCE

.1 Applicator’s qualifications: licenced or approved by insulation manufacturer.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Store products in strict accordance to manufacturer’s instructions in temperature controlled, dry and ventilated area.

1.5 AMBIENT REQUIREMENTS

.1 Ventilate area to receive insulation by introducing fresh air and exhausting air continuously during and minimum 24 hours after application to maintain non-toxic, unpolluted, safe working conditions.

.2 Apply foamed-in-place insulation and sealants only when substrate and ambient temperatures are within prescribed limits.

.3 Ensure temperature is maintained throughout curing period.

Part 2 Products

2.1 MATERIALS

.1 Use of insulation products manufactured with CFCs as blowing agents is prohibited.

.2 Primers: in accordance with manufacturer's recommendations for surface conditions. Low VOC.

.3 Spray foam insulation: to ULC 705.1, closed cell, spray-applied rigid cellular polyurethane foam air barrier and thermal insulation, high density. Low VOC.

Part 3 Execution

3.1 PREPARATION

.1 Clean surfaces which are to receive insulation, of dirt, dust, grease, loose material or other foreign matter which may inhibit adhesion.

.2 Provide sufficient ventilation during and until insulation has cured, to ensure safe working conditions. Introduce fresh air and exhaust air continuously during the 24 hour period after application to maintain non-toxic, unpolluted, safe working conditions.

.3 Ensure substrates are free of surface moisture before application.

3.2 PROTECTION

.1 Provide temporary enclosures to prevent spray and noxious vapour from contaminating air beyond application area.

.2 Protect workers as recommended by insulation manufacturer.

.3 Protect adjacent surfaces and equipment from damage by over spray, fall-out, and dusting of insulation materials.

.4 Dispose of waste foam daily and decontaminate empty drums in accordance with foam manufacturer's instructions.

3.3 APPLICATION

.1 Apply materials in accordance with ULC 705.2, and manufacturer’s written instructions.

.2 Apply primer when required to properly prepared substrates for special conditions required by foam insulation manufacturer’s requirements.

.3 Finished surface: free of voids and imbedded objects.

.4 Apply spray-foam insulation to uniform monolithic density without voids. Apply first layer in maximum 6mm lift, and subsequent layers in maximum 50mm thick lifts in single pass. Allow first layer to cure before applying subsequent layers.

.1 Where insulation is applied over multiple days or on adjoining walls, terminate layers of insulation in stepped fashion. Avoid butt joints or cold joints in insulation. Overlap minimum 300mm between layers.

.5 Apply to minimum cured thickness indicated.

.6 Installation around Protrusions Through Air Seal:

.1 Install spray-foam insulation around protrusions including mechanical and electrical protrusions, electrical chases, exhaust systems, heating and cooling ducts, sole plates, top plates, wall sections, and elsewhere as required to achieve and maintain continuity of thermal barrier around such protrusions.

3.4 CLEANING

.1 Remove masking materials and overspray from adjacent areas immediately after foam surface has hardened.

.2 Repair damaged areas in accordance with manufacturer's instructions.

3.5 PROTECTION

.1 Protect applied materials from damage during construction.

.2 Repair damage to adjacent materials caused by application of insulation.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34 – Vapour Barrier, Polyethylene Sheet for Use in Building Construction

Part 2 PRODUCTS

2.1 SHEET VAPOUR BARRIER

.1 Polyethylene film: to CAN/CGSB-51.34, Type 1, 0.15mm (6 mil) thick.

2.2 ACCESSORIES

.1 Joint sealing tape: air-resistant, pressure-sensitive adhesive tape, type recommended by vapour barrier manufacturer, 50mm (2”) wide for lap joints and perimeter seals, 25mm (1”) wide elsewhere.

.2 Sealants: to Section 07 92 00, Joint Sealants.

.3 Staples: minimum 6mm (1/4”) leg.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Install sheet vapour barrier on warm side of exterior wall assemblies to form continuous barrier.

.2 Use sheets of largest practical size to minimize joints.

.3 Inspect sheets for continuity. Repair punctures and tears with sealing tape before Work is concealed.

3.2 EXTERIOR SURFACE OPENINGS

.1 Cut sheet vapour barrier to form openings and ensure material is lapped and sealed to frame.

3.3 PERIMETER SEALS

.1 Seal perimeter of sheet vapour barrier as follows:

.1 Apply continuous bead of sealant to substrate at perimeter of sheets.

.2 Lap sheet over sealant and press into sealant bead.

.3 Install staples through lapped sheets at sealant bead into wood substrate.

.4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.4 LAP JOINT SEALS

.1 Seal lap joints of sheet vapour barrier as follows:

.1 Attach first sheet to substrate.

.2 Apply continuous bead of sealant over solid backing at joint.

.3 Lap adjoining sheet, minimum 150mm (6”), and press into sealant bead.

.4 Install staples through lapped sheets at sealant bead into wood substrate.

.5 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM)

- .1 ASTM D882 – Standard Test Method for Tensile Properties of Thin Plastic Sheeting
- .2 ASTM D1117 – Standard Guide for Evaluating Non-woven Fabrics
- .3 ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials
- .4 ASTM E96 – Standard Test Method for Water Vapor Transmission of Materials
- .5 ASTM E1677 – Standard Specification for Air Retarder Material or System for Framed Building Walls
- .6 ASTM E2178 – Standard Test Method for Air Permeance of Building Materials
- .7 ASTM E2357 – Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

.2 American Association of Textile Chemists and Colorists (AATCC)

- .1 AATCC Test Method 127 Water Resistance: Hydrostatic Pressure Test

.3 Technical Association of the Pulp and Paper Industry (TAPPI)

- .1 TAPPI Test Method T-410; Grams of Paper and Paperboard (Weight per Unit Area)
- .2 TAPPI Test Method T-460; Air Resistance (Gurley Hill Method)

1.2 DELIVERY, STORAGE AND HANDLING

.1 Deliver air infiltration barrier materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.

.2 Store air infiltration barrier materials as recommended by weather barrier manufacturer.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Air infiltration barrier: spunbonded polyolefin, non-woven, non-perforated, weather barrier. Standard of acceptance: DuPont Tyvek CommercialWrap, or acceptable "as Equal", with the following performance characteristics:

- .1 Air penetration:
  - .1 0.001 cfm/ft^2 at 75 Pa, when tested in accordance with ASTM E2178
  - .2 Type I, per ASTM E1677

.3 ≤0.04 cfm/ft^2 at 75 Pa, when tested in accordance with ASTM E2357

.2 Water vapor transmission: 28 perms, when tested in accordance with ASTM E96, Method B

.3 Water penetration resistance: minimum 280 cm when tested in accordance with AATCC Test Method 127

.4 Basis weight: minimum 2.7 oz/yd^2, when tested in accordance with TAPPI Test Method T-410

.5 Air resistance: air infiltration at >1500 seconds, when tested in accordance with TAPPI Test Method T-460

.6 Tensile strength: minimum 38/35 lbs/in., when tested in accordance with ASTM D882, Method A

.7 Tear resistance: 12/10 lbs., when tested in accordance with ASTM D1117

.8 Surface burning characteristics: Class A, when tested in accordance with ASTM E84. Flame Spread: 10, Smoke Developed: 10

.2 Accessories:

.1 Seam tape: as recommended by the air infiltration barrier manufacturer.

.2 Fasteners:

.1 Steel frame construction: 41mm (1-5/8”) rust resistant screw with 50mm (2”) diameter plastic cap or manufacturer approved 31mm (1-1/4”) or 50mm (2”) metal gasketed washer

.2 Wood frame construction: nail caps – #4 nails with large 25mm (1”) plastic cap fasteners, or 25mm (1”) plastic cap staples with leg length sufficient to achieve a minimum penetration of 16mm (5/8”) into the wood stud

.3 Flashings: refer to Section 07 62 00, Sheet Metal Flashing and Trim.

.4 Sealants: refer to Section 07 92 00, Joint Sealants.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Install air infiltration barrier over face of exterior wall substrate in accordance with manufacturer’s recommendations.

.2 Install air infiltration barrier prior to installation of windows and doors.

.3 Start air infiltration barrier installation at a building corner, leaving 150mm to 305mm (6” to 12”) of air infiltration barrier extended beyond corner to overlap.

.4 Install air infiltration barrier in a horizontal manner starting at the lower portion of the wall surface with subsequent layers installed in a shingling manner to overlap lower layers. Maintain air infiltration barrier plumb and level.

.5 Sill plate interface: extend lower edge of air infiltration barrier over sill plate interface 75mm to 150mm (3” to 6”). Secure to foundation with elastomeric sealant as recommended by air infiltration barrier manufacturer.

.6 Window and door openings:

.1 Extend air infiltration barrier completely over openings.

.2 Prepare openings in accordance with manufacturer's recommendations.

.7 Overlap weather barrier minimum 305mm (12") at exterior corners, and minimum 150mm (6") at seams.

.8 Air infiltration barrier attachment:

.1 Wood or steel frame construction: attach air infiltration barrier to studs through exterior sheathing. Secure using manufacturer recommend fasteners, space 305mm to 450mm (12" to 18") vertically on center along stud line, and 610mm (24") on center, maximum horizontally.

3.2 SEAMING

.1 Seal seams of air infiltration barrier with seam tape at all vertical and horizontal overlapping seams.

.2 Seal any tears or cuts as recommended by air infiltration barrier manufacturer.

3.3 PROTECTION

.1 Protect installed air infiltration barrier from damage.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D4541 – Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

.2 Canadian Construction Materials Centre (CCMC)

.1 CCMC Technical Guide for Air Barrier Systems for Exterior Walls of Low-Rise Buildings

.3 Canadian Standards Association (CSA)

.1 CSA S478 – Guideline on Durability in Buildings

1.2 QUALITY ASSURANCE

.1 Air/vapour barrier membrane and accessories shall be installed by a qualified contractor, specializing in performing the Work of this Section, and officially recognized as a Licensed Contractor by the National Air Barrier Association (NABA).

.2 Perform Work in accordance with the Sealant, Waterproofing and Restoration Institute, Sealant and Caulking Guide Specification, requirements for materials and installation.

1.3 SUBMITTALS

.1 Submit certified copy of test data from recognized independent testing laboratory confirming performance properties of air/vapour barrier membrane.

.2 Submit 300mm x 300mm (12” x 12”) samples of air/vapour barrier membrane.

.3 Provide data on material characteristics, performance criteria, and limitations.

.4 Submit manufacturer’s installation instructions, indicating preparation and installation requirements and techniques.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver all air/vapour barrier membrane and accessory materials to the project site in original and un-opened packaging with the manufacturer’s label intact, including name of contents and product code, net weight of contents, lot or batch number, storage temperature limits, shelf life expiration date, and safety information and instructions.

.2 Provide raised platforms, waterproof coverings and interior storage as necessary to protect materials from direct sunlight, chemicals, solvents, precipitation, ground moisture and temperature extremes, as per manufacturer’s recommendations.

.3 Do not double stack pallets of air/vapour barrier membrane. Protect rolls from direct sunlight until ready for use.

.4 Adhesives and primers contain solvents and are flammable. Do not store or use near open flame or spark.

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Except as explicitly permitted by the materials manufacturer, no installation Work shall be performed on walls exposed to inclement weather or on frost covered or wet surfaces.

.2 Substrate shall be protected from exposure to moisture following application, until building envelope is complete.

.3 Do not install solvent curing sealants or vapour release adhesive materials in enclosed spaces without ventilation.

.4 Maintain temperature and humidity recommended by the materials manufacturer before, during and after installation.

.5 Concrete block assemblies shall be cured a minimum of seven (7) days and be free of surface moisture. Allow a minimum of 24 hours drying period following precipitation.

.6 Prior to installation, inspect those areas to receive the air/vapour barrier membrane to ensure that they are clean, dry, sound, smooth and continuous.

.7 Do not commence air/vapour barrier membrane installation until roofing has been installed, including over parapets.

1.6 SCHEDULING

.1 Work shall be scheduled to provide an airtight seal at the end of each working day on the area worked upon during the day.

.2 Coordinate Work of this Section with all other applicable Sections to ensure continuity of air seal.

1.7 DURABILITY

.1 Product manufacturers shall certify their products will meet all characteristics required by CSA S478.

1.8 WARRANTY

.1 Applicator shall warrant installed sealant and sheet materials from failure to achieve air tight and watertight seals, loss of adhesion or cohesion, or failure to cure, in accordance with GC 12.3, for a period of three (3) years.

Part 2 PRODUCTS

2.1 MEMBRANE MATERIALS

.1 Membrane materials shall be approved by the manufacturer for use on the substrate to which it is being applied and for both the conditions during installation and for the long term operating conditions of the building.

.2 The manufacturer shall supply the Contractor with current laboratory test results for materials provided to the project. Test results shall be from an independent test agency using approved test methods to establish expected performance of the air barrier membrane.

2.2 MEMBRANE AIR/VAPOUR BARRIER

.1 Acceptable products:

- .1 Blueskin SA, as manufactured by Bakor
- .2 Sopraseal Stick 1100, as manufactured by Soprema
- .3 AquaBarrier AVB, as manufactured by IKO Industries

.2 Ensure compatibility with other building membrane components.

.3 Provide suitable primer for substrate to manufacturer’s recommendations.

.4 Include suitable mastic membrane and sealants to seal end laps, terminations and around protrusions such as masonry ties.

2.3 ACCESSORY PRODUCTS AND MATERIAL COMPATIBILITY

.1 Accessory products including caulks and sealants, primers, etc., which are in direct contact with, or form part of, the air barrier systems must be chemically and physically compatible with the materials to which they are applied and must be approved for that use by their manufacturer and the manufacturers of the air barrier materials they contact.

.2 Transition membrane:

- .1 Blueskin SA, as manufactured by Bakor
- .2 Sopraseal Stick 1100, as manufactured by Soprema
- .3 AquaBarrier AVB, as manufactured by IKO Industries

.3 Membrane backer: Galvanized steel sheet: minimum 0.38mm (0.015") Nominal Base Steel Thickness (NBST), commercial quality, with Z275 designation zinc coating.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Inspect all surfaces to receive the air/vapour barrier membrane to ensure that they are continuous, and free of voids and excessive gaps. Ensure surfaces are sound, smooth, flush, clean, dry, and free of contaminants that would impair adhesion. Fill all voids and provide backing at control joints.

.2 Sheathing shall be complete and laid up tight to all framed openings.

.3 The installer shall report in writing to the Contract Administrator, any defects in surfaces or conditions, which may adversely affect the performance of products installed under this Section prior to commencement of Work.

3.2 PREPARATION

.1 Remove loose or foreign matter, which might impair adhesion of materials.

.2 Clean and prime substrate surfaces in accordance with manufacturer's instructions.

3.3 INSTALLATION

.1 Install materials to prepared substrate in strict accordance with manufacturer's instructions.

.2 Prime only as much area as can be covered with membrane the same working day. Re-prime areas not covered the same working day.

.3 Detail work must be carefully carried out to ensure the air barrier membrane creates a continuous seal at all construction elements such as foundations, roofs and walls, and at junctures of different materials or construction types (windows, doors, etc). Where installation cannot be carried out using the primary membrane and compatible materials, select other materials, which suit the application.

.4 Install membrane backer across expansion joints and gaps in back-up materials, and fasten to one (1) side of joint only, to allow for expected movement.

.5 Install air/vapour barrier membrane horizontally beginning at the base of the wall area.

.6 Use sheets of largest practical length to minimize joints.

.7 Subsequent sheets shall overlap the sheet below ± 50mm (2"). Minimum overlaps shall be 40mm (1.5"). Where reverse shingle lapping occurs, mechanically fasten top edge of membrane at 150mm (6") centres, and apply bead of bituthene mastic along the top edge.

.8 End laps shall have minimum 50mm (2") overlap.

.9 Press membrane firmly into place by means of a hand roller to ensure continuous and intimate contact with the substrate.

.10 Continue the membrane into all openings in the wall area (i.e.: windows, doors, etc.) and terminate at a point that will not be visible from the interior.

.11 Apply transition membrane to prepared surfaces as indicated on drawings and as required by site conditions. Follow manufacturer's recommendations when installing air barrier membranes across unsupported openings (i.e.: around windows, below edge beams, etc.)

.12 Ensure that the air/vapour barrier material is structurally supported in all areas including transition areas as per National Building Code (NBC) requirements. Provide membrane backer where required.

.13 Fit membrane tightly around all penetrations through it, and seal using compatible mastic.

.14 Staple vapour retardant sheet strip to underside of nailers before installation. Apply strip continuous, free of wrinkles and tears, with at least 200mm (8") exposed for overlap on roof deck.

.15 At the end of each work day, apply a bead of compatible mastic along the top edge of partially completed membrane to prevent precipitation from under-mining its adhesion. Tool the mastic to ensure it is worked into the surface of the sheathing.

.16 Prior to covering the membrane, inspect sheets for continuity. Repair punctures, damaged areas or inadequately lapped seams using membrane appropriately sized to extend a minimum of 120mm (4-2/3") in all directions from the perimeter of the affected area.

.17 Apply sealant within recommended application temperature ranges. Consult manufacturer for other conditions.

3.4 PROTECTION

.1 Protect finished Work in accordance with Section 01 50 00, Temporary Facilities. Do not permit adjacent work to damage work of this section.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA)

.1 CAN/CSA-S136 – North American Specification for the Design of Cold Formed Steel Structural Members

1.2 QUALITY ASSURANCE

.1 Do prefinished metal cladding to manufacturer's specifications and CAN/CSA-S136.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00, Submittal Procedures.

.2 Shop drawings shall clearly indicate dimensions, cladding profiles, attachment methods, elevations, trim and closure pieces, and related Work.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Metal cladding panels: horizontal corrugated, profile to be selected by Contract Administrator, prefinished steel, including all exposed trim and flashings, 1.2mm (18 gauge) thick base metal.

.2 Finish: factory prefinished, to be selected from manufacturer's full colour range.

.3 Accessories:

.1 Exposed trim, closures, cap pieces, etc. of same material and colour as panels

.2 Sub-girts, hangers and fasteners, sized by supplier to suit application, to provide secure anchorage without deflection

.4 Sealants: in accordance with Section 07 92 00, Joint Sealants. Colour, where exposed, to be selected by Contract Administrator.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Prior to installation, inspect the wall framing to ensure there is sufficient support, properly spaced and anchored, for the metal cladding.

3.2 INSTALLATION

.1 Install sub-girts and purlins, secured to back-up wall, properly spaced and anchored to support the metal cladding.

.2 Install sill flashings, starter strips, inside corners, edgings.

.3 Install panels to manufacturer's instructions.

.4 Install exterior corners, fillers and closure strips with carefully formed and profiled work using concealed fasteners.

.5 Maintain joints in panels, true to line, tight fitting.

.6 Caulk and seal in accordance with manufacturer's specifications.

.7 Provide all components including drip and cap flashings, screws and fasteners, as required, for a complete installation.

.8 Conceal all fasteners where practicable.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

.1 Steel faced, polyisocyanurate insulated, fire resistive wall panels for interior partitions.

.2 Accessories include fasteners and perimeter trim.

1.2 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

.2 ASTM A755 – Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products

.3 ASTM C165 – Standard Test Method for Measuring Compressive Properties of Thermal Insulations

.4 ASTM C303 – Standard Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation

.5 ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

.6 ASTM C612 – Standard Specification for Mineral Fiber Block and Board Thermal Insulation

.7 ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials

.8 ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials

.9 ASTM E136 – Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750° C

.10 ASTM E283 – Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

.11 ASTM E331 – Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference

.12 ASTM E814 – Standard Test Method for Fire Tests of Penetration Firestop Systems

.2 Underwriters Laboratories (UL)

.1 UL 1479 – Fire Tests of Through-Penetration Fire Stops

.3 Underwriters Laboratories of Canada (ULC)

.1 ULC 101 – Standard Methods of Fire Endurance Tests of Building Construction and Materials

.2 ULC 114 – Standard Method of Test for Determination of Non-Combustibility in Building Materials

.3 ULC 115 – Standard Method of Fire Tests of Firestop Systems

1.3 QUALITY ASSURANCE

.1 Manufacturer qualifications: manufacturer shall have a minimum of five (5) years experience in the production of fire resistive insulated metal wall panels. Manufacturer shall demonstrate past experience with examples of projects of similar type and exposure.

.2 Installer qualifications: installer shall be authorized by the manufacturer and the work shall be supervised by a person having successfully completed a manufacturer training seminar regarding proper installation of the specified product.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00, Submittal Procedures.

.2 Shop drawings: submit detailed drawings showing:

.1 Profile

.2 Gauge of both exterior and interior sheet

.3 Location, layout and dimensions of panels

.4 Location and type of fasteners

.5 Shape and method of attachment of all trim

.6 Locations and types of sealants

.7 Installation sequence

.8 Coordination drawings: provide elevation drawings and building sections which show panels in relationship to required locations for structural support. Include panel details and details showing attachment to structural support.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Refer to Section 01 60 00 – Common Product Requirements.

.2 Deliver panel materials and components in manufacturer's original, unopened, undamaged packaging with identification labels intact.

.3 Store wall panel materials on dry, level, firm, and clean surface. Stack no more than two (2) bundles high. Elevate one end of bundle to allow moisture run-off, cover and ventilate to allow air to circulate and moisture to escape.

1.6 WARRANTY

.1 Limited Warranty: Standard form in which manufacturer agrees to repair or replace items that fail in materials or workmanship within specified warranty period. The items covered by the warranty include structural performance including bond integrity, deflection and buckling.

.1 Warranty Period: Two (2) years from date of Substantial Completion.

.2 Panel Finish Warranty: Submit Manufacturer's limited warranty on the exterior paint finish for adhesion to the metal substrate and limited warranty on the exterior paint finish for chalk and fade.

.3 Thermal Warranty: Submit Manufacturer's standard form in which manufacturer agrees to repair or replace panels that exhibit great than 10% reduction from published R-value at time of manufacture as measured in accordance with ASTM C518 within warranty period of 30 years from date of Substantial Completion.

Part 2 PRODUCTS

2.1 MANUFACTURER

.1 Standard of acceptance: Kingspan QuadCore, KS Series, as manufactured by Kingspan Insulated Panels Ltd., or approved equal.

2.2 PERFORMANCE CRITERIA

.1 Structural test: deflection criteria shall be L/180.

.2 Freeze/heat cycling test: panels shall exhibit no delamination, surface blisters, permanent bowing or deformation when subjected to cyclic temperature extremes of minus 36 deg. F to plus 180 deg. F temperatures for 21, eight (8) hour cycles.

.3 Water penetration: there shall be no uncontrolled water penetration through the panel joints at pressure differential of 20 psf, when tested in accordance with ASTM E331.

.4 Dynamic water penetration: there shall be no uncontrolled water penetration through the panel assembly at a pressure difference of 15 psf, when tested in accordance with AAMA 501.1.

.5 Air infiltration: air infiltration through panel shall not exceed 0.01 cfm/sf at 6.24 psf air pressure differential when tested in accordance with ASTM E283.

.6 Humidity test: panels shall exhibit no delamination or metal interface corrosion when subjected to plus 140 deg. F temperature and 100 percent relative humidity for a total of 1500 hours (62 days).

.7 Autoclave test: panels shall exhibit no delamination or shrinkage/melting of the foam core from the metal skins after being subjected in an autoclave to a pressure of 2psig (13.8kPa) at a temperature of plus 218 deg. F (plus 103 deg. C) for a period of 2 1/2 hours.

.8 Fire test response characteristics: steel-faced panels with polyisocyanurate (ISO) core shall comply with appropriate sections of Chapter 26 of the International Building Code regarding the use of Foam Plastic.

.1 Flame Spread and Smoke Developed Tests on exposed Insulating Core:

.1 ASTM E84 Flame spread and smoke developed indices:

.1 Flame Spread: 25 or less.

.2 Smoke Developed: 90 or less.

.2 ULC 102 Flame spread and smoke developed indices:

.1 Flame Spread: 30 or less.

.2 Smoke Developed: 45 or less.

.2 NFPA 259 Potential Heat Content; established for foam core.

.3 NFPA 268 Ignitability of Exterior Wall Assemblies Using a Radiant Heat Source; successfully passed acceptance criteria.

.4 NFPA 285 Intermediate Scale Multi-story Fire Evaluation; successfully passed acceptance criteria when installed per listed details.

.5 UL 263 Fire Resistive Rating; classified as a component of a fire-rated wall assembly for 1-hour and 2-hour rating Design No. U053 (rated assemblies include appropriate layers of fire-rated Type X Gypsum board).

.6 ULC 101 Standard Methods of Fire Endurance Tests of Building Construction Materials

.1 Fire Endurance Test – 10 minutes: 3 inch or greater Panels remained in place without joint stitch fastening

.2 Fire Endurance Test – 10 minutes: Less than 3 inch Panels remained in place with joint stitch fastening

.7 ASTM D1929 Minimum Flash and Self Ignition; established for foam core.

.8 S101, S102, S127, S134, S138 UL Canada fire test standards; successfully passed.

.9 Insulating Core: QuadCore Polyisocyanurate (POLYISO) core, ASTM C591 Type IV, CFC and HCFC free, compliant with Montreal Protocol and Clean Air Act, with the following minimum physical properties:

.1 Core is 95 percent closed cell when tested in accordance with ASTM D6226

.2 Panel shall provide a nominal R-values of 8.0 hr·ft2·°F/Btu per inch thickness when tested in accordance with ASTM C 518 at 75°F mean temperature and 9.0 hr·ft2·°F/Btu per inch thickness when tested in accordance with ASTM C 518 at 35°F mean temperature.

.3 Foam has a density of 2.2 to 2.8 pounds per cubic foot when tested in accordance with ASTM D1622

.4 Compressive Stress: Panels shall have a compressive stress of 24 psi. when tested according to ASTM D1621

.5 Shear Stress: 22 psi when tested in accordance with ASTM C273

.6 Tensile Stress: 24 psi when tested in accordance with ASTM D1623

.7 Oven Aging at 212 degrees F:

.1 14 days: minus 0.6 percent volume change

.2 Tested according to ASTM D2126

.8 Low Temperature Aging at minus 40 degrees F:

.1 14 days: minus 0.2 percent volume change

.2 Tested according to ASTM D2126

.10 Paint Finish Characteristics:

.1 Gloss: 15 ± 5 measured at 60 degree angle tested in accordance with ASTM D523.

.2 Pencil Hardness: HB-H minimum tested in accordance with ASTM D3363.

.3 Flexibility, T-Bend: 1-2T bend with no adhesion loss when tested in accordance with ASTM D4145.

.4 Flexibility, Mandrel: No cracking when bent 180° around a 1/8 mandrel as tested in accordance with ASTM D522.

.5 Adhesion: No adhesion loss tested in accordance with ASTM D3359.

.6 Reverse Impact: No cracking or adhesion loss when impacted 3000 by inches of metal thickness (lb-in), tested in accordance with ASTM D2794.

.7 Abrasion Resistance: Nominal 65 liters of falling sand to expose 5/32 inch diameter of metal substrate when tested in accordance with ASTM D968.

.8 Graffiti Resistance: Minimal effect.

.9 Acid Pollutant Resistance: No effect when subjected to 30 percent sulfuric acid for 18 hours, or 10 percent muriatic acid for 15 minutes when tested in accordance with ASTM D1308.

.10 Salt Fog Resistance: Passes 1000 hours, when tested in accordance with ASTM B117 (5 percent salt fog at 95 deg. F).

.11 Cyclic Salt Fog and UV Exposure: Passes 2016 hours when tested in accordance with ASTM D5894.

.12 Humidity Resistance: Passes 1500 hours at 100 percent relative humidity and 95 deg. F, with a test rating of 10 when tested in accordance with ASTM D2247, and D714.

.13 Colour Retention: Passes 5000 hours when tested in accordance with ASTM G153 and G154.

.14 Chalk Resistance: Maximum chalk is a rating of 8 when tested in accordance with ASTM D4214, Method A.

.15 Colour Tolerances: Maximum of 5ΔE Hunter units on panels when tested in accordance with ASTM D2244.

2.3 WALL PANELS

.1 Description:

.1 Panel thickness:

.1 Typical: 100mm (4”).

.2 Chase: 50mm (2”).

.2 Panel width: 1067mm (42”).

.3 Fire rating: 2-hour.

.4 Panel attachment: fasters and stainless steel attachment clip completely concealed within panel side joint.

.5 Horizontal panel joint reveals: 9mm (3/8”).

.6 Vertical joint treatments (for horizontal panels):

.1 Panel trimless ends with black gasket insert

.2 Surface mounted aluminum extrusion with reveal and flush aluminum insert

.3 Surface mounted top hat metal flashing

.7 Vertical panel joint reveals: 3mm (1/8”).

.8 Exterior paint finish colour:

.1 Material: steel coil material shall be in accordance with ASTM A755, AZ50 Galvalume®/ Zincalume® (55 percent aluminum, 45 percent zinc) in accordance with ASTM A792.

.2 Gauge: 24 gauge.

.3 Profile: Azteco.

.4 Texture: Non-directional stucco embossed, Smooth.

.5 Finish: to be selected from manufacturer’s full range.

.9 Interior face of panel:

.1 Material: steel coil material shall be in accordance with ASTM A755, AZ50 Galvalume®/ Zincalume® (55 percent aluminum, 45 percent zinc) in accordance with ASTM A792.

.2 Profile: Shadowline.

.1 Profile description: linear striations nominal 1.58mm (0.0625”) deep by 19mm (3/4") wide at 75mm (3”) on center.

.3 Texture: non-directional stucco embossed.

.4 Gauge: 24 gauge.

.5 Finish: to be selected from manufacturer’s full range.

2.4 ACCESSORIES

.1 Fasteners:

.1 Self drilling fasteners shall be corrosion resistant plated steel with neoprene washer, as recommended by manufacturer.

.2 Material: hex-head type with steel and neoprene washer and 12 gauge stainless steel clip supplied by the manufacturer.

.3 Size: as recommended by manufacturer.

.2 Perimeter trim: Fabricated perimeter trim and metal flashing: Shall be same gauge, material and coating color as exterior face of insulated metal wall panel.

.2 Extruded perimeter trim: Shall be extruded aluminum 6063-T5 alloy with spray applied PVF coating in same color as exterior face of insulated metal wall panel.

.3 Sealants: Butyl, non-skinning/curing type as recommended by manufacturer.

.4 Butyl tape: as recommended by manufacturer.

Part 3 EXECUTION

3.1 INSPECTION

.1 Prior to installation, inspect the wall framing to ensure there is sufficient support, properly spaced and anchored, for the metal cladding.

.2 Ensure items projecting through the cladding are solidly set and anchored.

3.2 INSTALLATION

.1 Installation shall be in accordance with manufacturer's installation guidelines and recommendations.

.2 Install panels plumb, level, and true-to-line to dimensions and layout indicated on approved shop drawings.

.3 Cut panels prior to installing, where indicated on shop drawings, using a power circular saw with fine tooth carbide tip blade per manufacturer's instructions. Personnel should wear respiratory and eye protection devices.

.4 Butyl weather barrier sealant:

.1 Apply non-skinning butyl sealant as shown on shop drawings and manufacturer's installation instructions so as to complete the necessary vapour barrier.

.2 Use non-skinning butyl tube sealant only for tight metal-to-metal contact.

.3 Do not use non-skinning butyl tube sealant to bridge gaps.

.5 Place panel fasteners through pre-punched holes in attachment clips, concealed within the joint of the panel. Secure units to the structural supports. Space clips as recommended by manufacturer or otherwise indicated on the approved shop drawings.

3.3 TRIM INSTALLATION

.1 Place trim and trim fasteners only as indicated per details on the approved shop drawings.

.2 Field drill weep holes where appropriate in horizontal trim where indicated on shop drawings.

.3 Place a continuous strip of butyl tube sealant between the inside back face of closure trims and interior panel faces for proper vapour seal.

3.4 SEALANT INSTALLTION FOR EXPOSED JOINTS

.1 Clean and prime surfaces to receive exterior exposed sealants in accordance with sealant manufacturer's recommendations.

.2 Follow sealant manufacturer's recommendations for joint width-to-depth ratio, application temperature range, size and type of backer rod, and compatibility of materials for adhesion.

.3 Direct contact between butyl and silicone sealants shall not be permitted.

3.5 CLEANING AND PROTECTION

.1 Remove protective film immediately after installation.

.2 Touch-up, repair or replace metal panels and trim that have been damaged.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D5147 – Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material

.2 Canadian General Standards Board (CGSB)

.1 CGSB 37-GP-56M – Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing

.2 CAN/CGSB-37.29 – Rubber-Asphalt Sealing Compound

.3 Canadian Roofing Contractors Association (CRCA)

.1 CRCA Roofing Specifications Manual

1.2 QUALITY ASSURANCE

.1 Do roofing Work to applicable standard in CRCA Roofing Specifications Manual, except where specified otherwise.

.2 Qualifications:

.1 Roofing Contractor shall be a member in good standing of the Roofing Contractors Association of Manitoba (RCAM) Inc., and the Canadian Roofing Contractors Association.

.2 The Roofing Contractor must, during the application of the modified bitumen membrane, have tradesmen on site at all times who have 40 hours of supervised, hands-on training of modified bitumen membrane application. The tradesmen must have in their possession, a current photo identification card identifying the training for that particular product.

.3 Installer qualifications: company or person specializing in application of modified bituminous roofing systems approved by manufacturer with five (5) years documented experience.

1.3 FIELD QUALITY CONTROL

.1 Inspection and testing of roof application will be carried out by a Building Envelope Commissioning Agent (BECA) engaged and paid for by The City.

.2 Notify agency minimum 48 hours prior to commencement of roofing operations to arrange inspection. Permit agency full access to all portions of Work.

.3 Inspections shall include: a ‘Final Inspection’ carried out after all roofing and building exterior is complete, including installation of equipment and openings, and shall be in the presence of the Contract Administrator and the Contractor.

.4 Site and test reports shall be distributed electronically to The City, Contract Administrator, Contractor, and other parties as requested.

1.4 COMPATIBILITY

.1 Compatibility between components of roofing system is essential. Bituminous adhesives, insulation, felts, and surface coatings, which are to be incorporated into system, must be compatible with each other.

.2 Provide written declaration that components of roofing system are compatible.

1.5 HANDLING AND STORAGE

.1 Provide and maintain dry, off-ground weatherproof storage.

.2 Store rolls on end with any selvage edge up, one (1) pallet high only, in dry location, with protection from inclement weather.

.3 Remove only in quantities required for same day use.

.4 Place plywood runways over Work to enable movement of material and other traffic.

.5 Store sealants at +5°C minimum.

.6 All materials on roof shall be stored in such a manner as to prevent blow-offs during high winds.

.7 No primer or other such pourable liquids shall be left on the roof or grounds after hours unless they are safely and securely locked up.

.8 Propane bottles shall be removed from the roof and site at the end of each work day.

1.6 ENVIRONMENTAL REQUIREMENTS

.1 Do not install roofing when temperature remains below -18°C for torch application.

.2 Install roofing on dry deck, free if snow and ice, use only dry materials, and apply only during weather that will not introduce moisture into roofing system.

1.7 PROTECTION

.1 Prior to the start of work, conduct a site inspection to ensure its safety in order to minimize fire risks and hazards.

.2 Respect safety measures recommended by the related local authorities.

.3 At the end of each workday, use heat detector gun to spot any smouldering or concealed fire. Job planning shall be organized to ensure workers are still on location at least one (1) hour after welding works. An inspection must be performed by an employee of roofing contractor who specializes in this kind of job at the end of works and, if necessary, with the help of a member of the fire protection service of the city.

.4 Never apply the torch directly to flammable materials.

.5 Throughout roofing installation, maintain a clean site and have a fire hose (when possible) and at least one ULC-approved Class A, B or C fire extinguisher, charged and in perfect operating condition, within 6m (20ft) of each torch. Respect all safety measures described in technical data sheets of sealants. Welding torches must never be placed near combustible or flammable products, nor be used where the flame is not visible or cannot be easily controlled.

.6 Protect finished roof in accordance with roof protection procedures as detailed in Section 01 57 00, Temporary Controls.

1.8 WARRANTY

.1 Warranty shall be a CRCA warranty.

.2 Contractor hereby warrants roofing and membrane flashings will stay in place and remain leak-proof for five (5) years.

.3 The membrane manufacturer will issue a written and signed document in The City's name, certifying that the roofing membranes are free of manufacturing defects for a period of ten (10) years, starting from the date of completion of membrane installation. This warranty will cover the removal and replacement of defective roof membrane products, including workmanship. The warranty must remain full and complete for the duration of the period specified. The warranty certificate must reflect these requirements.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Membranes, primers to be from a single manufacturer.

.2 Fibreglass matt gypsum roof board: 13mm (1/2”) thickness. Standard of acceptance: Georgia Pacific DensDeck Prime Roof Board, or approved equal.

.3 Roof vapour retardant: elastomeric styrene-butadiene-styrene (SBS) polymer modified bitumen reinforced with non-woven polyester mat, topside surfaced with fine mineral aggregate, underside surfaced with polyolefin burn-off film, to ASTM D5147. Standard of acceptance: Sopralene 180 SP 3.5mm, or approved equal.

.4 Roofing insulation:

.1 Glass fibre reinforced polyisocyanurate foam insulation, acrylic faced, RSI = 1.00/25mm, butt edges. Note: total thickness shall be composed of two (2) layers as noted on drawings. Standard of acceptance: Sopra-Iso Plus, by Soprema, or approved equal.

.2 Expanded polystyrene (tapered): thermal resistance allowable of RSI = 0.70/25mm (R = 4/in), Type 2, square edges, in two (2) layers. Acceptable products: PlastiSpan HD by Plasti-Fab, or Styrobar 22 by AMC Insulation Corp.

.1 Thickness: minimum 25mm at drain basins. Minimum 50mm below polyisocyanurate insulation.

.5 Polyiso protection board: 13mm (1/2") thick support panel composed of 180g/m^2 non-woven polyester reinforced SBS membrane with thermofusible surface, laminated on 100psi high-density polyisocyanurate insulation panel. Standard of acceptance: Soprasmart ISO HD 180, by Soprema, or approved equal.

.6 Primer: Elastocol 500, by Soprema, or approved equal.

.7 Adhesive: two (2) component, quick-setting, low-expansion foam urethane adhesive. Standard of acceptance: Duotack, by Soprema, or approved equal.

.8 Membrane roofing:

.1 Cap sheet: elastomeric modified bituminous membrane, cap sheet conforming to CGSB 37-GP-56M, Type 1, Class A (granule), Grade 2. Standard of acceptance: Soprastar Flam 250 GR, by Soprema, or approved equal.

.9 Membrane flashings:

.1 Self-adhering base sheet. Standard of acceptance: Sopraflash Flam Stick, by Soprema, or approved equal.

.10 Flame-stop membrane: self-adhesive membrane composed of SBS modified bitumen and glass mat reinforcement, designed to prevent flames from penetrating into voids, cavities and openings before installation heat-welded membranes. Standard of acceptance: SopraGuard tape, by Soprema, or approved equal.

.11 Pitch pocket filler: polyurethane pitch pocket system made of prefabricated modules of various sizes, with interlocking compounds and solvent-free mastic, composed of two (2) component urethane and mono-component elastomeric sealant. Standard of acceptance: Sopramastic, by Soprema, or approved equal.

.12 Vent stacks: Insulated Stack Jack Flashings with metal cap, SJ-20, as manufactured by Thaler, Hercules.

.13 Conduit flashing: insulated rigid conduit flashing, minimum 12" high aluminum with urethane insulated sleeve. Standard of acceptance: MEF-AE1, as manufactured by Thaler.

.14 Safety railing: non-penetrating, self-supporting roof safety guardrail, galvanized steel tube construction, colour to be selected by Contract Administrator, complete with rubber mats to protect existing roofing surface.

.1 Acceptable products:

.1 Skyline Group 5001 Roofbarrier Series

.2 Tritech Safety Rail 2000 Architectural Series

.3 Or approved equal

Part 3 EXECUTION

3.1 SURFACE EXAMINATION AND PREPARATION

.1 Surface examination and preparation must be completed in conformance with instructions in the membrane manufacturer's technical documentation.

.2 Complete removal of the existing roof as noted. Scrape deck clean of old roofing and insulation materials and any debris.

.3 Before roofing work begins, the roofing foreman will inspect and approve deck conditions (including slopes and wood grounds) as well as flashings at parapets, roof drains, plumbing vents, ventilation outlets and other construction joints. If necessary, a non-conformity notice will be issued to the Contractor so that required corrections can be carried out. The start of roofing work will be considered as acceptance of conditions for work completion.

.4 Do not begin any portion of work before surfaces are clean, smooth, dry, and free of ice and debris. Use of calcium or salt is forbidden for ice or snow removal.

.5 Ensure plumbing, carpentry and all other works have been duly completed.

.6 No materials shall be installed during rain or snowfall.

.7 Protect surrounding surfaces against damage from roofing Work.

.8 Ensure all debris, snow, standing water, dust, dirt, etc., is cleaned off deck prior to accepting the surfaces.

3.2 METHOD OF EXECUTION

.1 Roofing work must be completed in a continuous fashion as surfaces are readied and as weather conditions allows it.

.2 It is preferable to seal all joints that are not covered by a cap sheet membrane the same day. A second cap sheet cannot be installed if any moisture is present in joints.

.3 Ensure waterproofing of roofs at all times, including protection during installation work by other trades and protection as work is completed (e.g. vents, drains, etc.).

3.3 SITE PROTECTION

.1 Protect the exposed surfaces of finished work to avoid damage during roof installation and material transportation. Install walkways made of rigid boards over installed roofing materials to enable passage of people and transport of products. Assume full responsibility for any damage.

3.4 FIBERGLASS MATT GYPSUM ROOF BOARD

.1 Place with long axis of each sheet transverse to steel deck ribs, with end joints staggered and fully supported on ribs. Adhere with specified adhesive to meet minimum wind uplift of 90 mph with ribbons being spaced no greater than 300mm on centre in the main field of the roof and 150mm on center on the outer perimeter 1200mm. Ribbons shall run parallel with ribs of steel decking.

3.5 INSTALLATION OF ROOF VAPOUR RETARDANT

.1 Apply air/vapour barrier membrane to CRCA specifications, and manufacturer's specifications. Apply primer for peel and stick membranes, as recommended by the manufacturer.

.2 Extend vapour retardant under cant strips and blockings and provide lap with air/vapour barrier membrane of wall construction to provide continuity of building air/vapour barrier envelope.

.3 Apply a bead of mastic around the base of all plumbing stacks to ensure a continuous seal of the vapour barrier.

3.6 INSTALLATION OF DIVIDERS

.1 Install roof area dividers in roofing membranes where indicated, and as detailed on drawings and spec. details.

3.7 INSULATION

.1 Insulation layers shall be adhered with specified adhesive to meet minimum wind uplift of 90 mph with ribbons being spaced no greater than 300mm on centre in the main field of the roof and 150mm on center on the outer perimeter 1200mm. Add adhesive ribbons at 100mm at corners.

.2 Place boards in one (1) direction, stagger joints and offset layers from one another.

3.8 INSTALLATION OF FLAME-STOP MEMBRANE

.1 Adhere the membrane directly onto an approved substrate by removing the silicone release film. Flame-stop membrane is designed to prevent flames from penetrating into voids, cavities and openings while installing heat-welded membranes.

.2 Unroll the flame-stop membrane onto the insulation, being careful to overlap adjacent selvedges to ensure that the flame will not penetrate the insulation.

3.9 PROTECTION BOARD

.1 Adhere with specified adhesive to meet minimum wind uplift of 90 mph with ribbons being spaced no greater than 300mm on centre in the main field of the roof and 150mm on center on the outer perimeter 1200mm.

.2 Place boards in parallel rows with end joints staggered. Cap joints approximately 25mm.

3.10 MEMBRANE ROOFING

.1 Base sheet flashing installation:

- .1 Apply base sheet flashing only after primer coat is dry.
- .2 Before applying membranes, always burn the plastic film from the section to be covered if there is an overlap (inside and outside corners and field surface). For sanded base sheet membranes, apply primer for self-adhesive membrane on the area to be covered at the foot of the parapets.
- .3 Cut off corners at end laps of areas to be covered by the next roll.
- .4 Each selvedge will overlap the previous one along lines provided for this purpose, and by 150 mm (6 in) at the ends.
- .5 Position the pre-cut membrane. Remove 150 mm (6 in) of the silicone release film to hold the membrane in place at the top of the parapet.
- .6 Then, gradually peel off the remaining silicone release film, pressing down on the membrane with an aluminum applicator to ensure good adhesion. Use the aluminum applicator to ensure a perfect transition between the flashing and the field surface. Smooth the entire membrane surface with a membrane roller for full adhesion.
- .7 Install a reinforcing gusset at all inside and outside corners.
- .8 Always seal overlaps at the end of the workday.
- .9 Avoid the formation of wrinkles, swellings or fishmouths.

.2 Cap sheet installation:

- .1 Once base sheet is applied and no defects are apparent, proceed with cap sheet installation.
- .2 Begin with double-selvage starter roll. If starter roll is not used, side laps covered in granules must be degranulated by embedding side laps in torch-heated bitumen over a 75mm (3”) width.
- .3 Unroll cap sheet at drain. Carefully align first side lap (parallel to roof edge).
- .4 Weld cap sheet onto base sheet with torch recommended by membrane manufacturer. During application, simultaneously melt both designated contact surfaces so a bead of bitumen is apparent as cap sheet unrolls.
- .5 Avoid overheating.
- .6 Make sure joints between the two layers are staggered by at least 300mm (12”).

.7 Overlap cap sheet side laps by 75mm (3”) and end laps by 150mm (6”). Cut off corners at end laps to be covered by next roll. All overlap surfaces must be degranulated.

.8 Complete perfect welds between two membranes. Leave no zone unwelded. In cold weather, adjust welding time to obtain homogenous seam (it may be necessary to slow down in certain cases.)

.9 Once cap sheet is installed, carefully check all overlapped joints.

.10 During installation, take care to avoid excessive bitumen bleed-out at joints.

.3 Installation of cap sheets on up-stands and parapets (heat-welded):

.1 This cap sheet must be installed in 1000mm wide strips. The side joints must overlap by 75mm (3”) and must be staggered by at least 100mm (4”) with respect to the joints of the cap sheet on the field surface to avoid areas of excessive membrane thickness. The overlaps on the field surface must be 50mm (2”) wider than those of the base sheet membrane on the up-stands and parapets. At end laps, angle-cut the corners that will be covered by the following roll.

.2 Cut off corners at end laps on areas to be covered by the next roll.

.3 Use a chalk line to draw a straight line on the field surface 150mm (6”) from the up-stands and parapets.

.4 Use a propane torch and round-nose trowel to embed the surface granules in the layer of hot bitumen starting from the chalk line on the field surface to the bottom edge of the up-stand or parapet as well as on the granulated vertical surfaces that are to be overlapped.

.5 This cap sheet will be heat-welded directly to the base sheet membrane, proceeding from bottom to top. This technique softens both membranes in order to obtain even, continuous weld.

.6 During installation, be careful not to overheat the membrane or to create excessive bitumen bleeding at the joints.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM)

.1 ASTM B32 – Standard Specification for Solder Metal

.2 Canadian Standards Association (CSA)

.1 CSA-A123.3 – Asphalt Saturated Organic Roofing Felt

.2 CSA B111 – Wire Nails, Spikes and Staples

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-37.5 – Cutback Asphalt Plastic Cement

.2 CGSB 37-GP-5Ma – Application of Cutback Asphalt Plastic Cement

.4 Canadian Roofing Contractors Association (CRCA)

Part 2 PRODUCTS

2.1 SHEET METAL MATERIALS

.1 Galvanized steel sheet: minimum 0.61mm (24 gauge) Nominal Base Steel Thickness (NBST), commercial quality, with Z275 designation zinc coating.

.2 Prefinished steel sheet: minimum 0.61mm (24 gauge) NBST, Grade A steel, with Z275 designation zinc coating with baked enamel finish. Finish shall be factory prefinished high molecular polyester (HMP), 8000+ series, one (1) side, to be selected from industry standard colour range and extended colour range.

2.2 ACCESSORIES

.1 Plastic cement: to CAN/CGSB-37.5.

.2 Isolation coating: alkali-resistant bituminous paint.

.3 Underlay for metal flashing: No. 15 perforated asphalt felt to CSA-A123.3.

.4 Sealants: in accordance with Section 07 92 00, Joint Sealants, colour to be selected.

.5 Cleats: of same material and temper as sheet metal, minimum 50mm (2”) wide. Thickness same as sheet metal being secured.

.6 Fasteners: of same material as sheet metal, to CSA B111, flat head roofing nails of length and thickness suitable for metal flashing application.

.7 Washers: of same material as sheet metal, 1mm (0.04”) thick, with rubber packing.

.8 Solder: to ASTM B32, 50% tin and 50% lead.

.9 Flux: Rosin, cut hydrochloric acid, or commercial preparation suitable for materials to be soldered.

.10 Touch-up paint: as recommended by prefinished material manufacturer.

2.3 FABRICATION

.1 Fabricate metal flashings and other sheet metal Work to applicable CRCA 'FL' series specifications.

.2 Form pieces in 2440mm (8ft) lengths, except where shorter sections are permitted to accommodate corners, junctions and terminations. Make allowance for expansion at joints.

.3 Hem exposed edges on underside 13mm (1/2"). Mitre and seal corners with sealant.

.4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.5 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

2.4 METAL FLASHINGS

.1 Form flashings and fascias, to profiles indicated, of galvanized steel, except as noted.

.2 Form flashings and fascias, exposed to view, from prefinished sheet steel, unless noted otherwise.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Install sheet metal Work to CRCA applicable 'FL' series specifications.

.2 Use concealed fastenings, except where approved before installation.

.3 Provide underlay under sheet metal. Secure in place and lap joints 100mm (4").

.4 Install surface mounted reglets true and level, and caulk top of reglet with sealant.

END OF SECTION

Part 1 GENERAL

1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product data: submit manufacturer's instructions, printed product literature and data sheets for roof hatches and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop drawings:

.1 Indicate size and description of components, materials, attachment devices, description of frame and finish, and construction details.

1.2 CLOSEOUT SUBMITTALS

.1 Provide in accordance with Section 01 78 00 – Closeout Submittals.

.2 Maintenance data:

.1 Submit operation and maintenance data for hardware complete with pertinent details, spare parts lists and warnings against harmful maintenance materials and practices for incorporation into manual.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver and store in manufacturer’s original unopened packaging, to prevent damage.

Part 2 PRODUCTS

2.1 DESIGN REQUIREMENTS

.1 Cover shall be reinforced to support a minimum live load of 40 psf with a maximum deflection of 1/150th of the span and a maximum design pressure of +/- 100 PSF with a design factor of 2 for galvanized steel.

.2 Operation of cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.

.3 Operation of the cover shall not be affected by temperature.

.4 Entire hatch shall be weather tight with fully welded corner joints on cover and curb.

2.2 ROOF HATCH

.1 Cover: shall be 1.9mm (14 gauge) galvannealed steel with 75mm (3”) beaded flange with formed reinforcing members. Cover shall have heavy extruded EPDM rubber

gasket bonded to cover interior to ensure continuous seal when compressed to top surface of curb.

.2 Cover insulation: fiberglass, 25mm (1") thickness, fully covered and protected by metal liner constructed from 0.8mm (22 gauge) galvannealed steel.

.3 Curb: 305mm (12")) in height , constructed from 1.9mm (14 gauge) galvannealed steel. Curb shall be formed with 89mm (3.5") flange with holes for securing to roof deck. Curb shall be equipped with integral metal cap flashing of same gauge and material as curb, fully welded at the corners, including stamped tabs to be bent inward to hold single ply roofing membrane securely in place.

.4 Curb insulation: rigid, high-density fiberboard of 25mm (1") thickness on outside of curb.

.5 Lifting mechanisms: compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout entire arc of opening and closing.

.6 Hardware:

.1 Heavy pintle hinges.

.2 Cover shall be equipped with spring latch with interior and exterior turn handles.

.3 Interior and exterior padlock hasps.

.4 Latch strike shall be stamped component bolted to curb assembly.

.5 Cover shall automatically lock in open position with rigid hold open arm, equipped with handle to permit easy release for closing.

.6 All hardware shall be zinc plated and chromate sealed.

.7 Finish: manufacturer's standard finish.

.8 Size: as indicated on drawings.

.9 Standard of acceptance:

.1 Bilco, Type S

.2 Maxam, Model MAX-14

.3 Nystrom, Personnel Hatch

.4 Acudor, RHG

.5 or approved equal

2.3 ACCESSORIES

.1 Ladder safety post: telescoping safety post, pre-assembled by manufacturer, constructed with high strength square tubing. Safety post shall lock automatically when fully extended, with release lever to disengage post and return to lowered position. Post shall be complete with adjustable mounting brackets for mounting to top two (2) rungs of access ladder.

.1 Material and finish: mill finish aluminum.

.2 Standard of acceptance:

.1 Bilco LadderUP, Type LU-4

.2 Maxam, Model LP-4

.3 Nystrom, Model SPA

.4 Acudor, TSP-1

.5 or approved equal

.3 Provide one (1) ladder safety post for each roof hatch.

.2 Fixed hatch railing system: hatch rail system constructed from aluminum posts and rails, powder coat paint finish in safety yellow, self-closing and locking gate with stainless steel gate springs and fasteners.

.1 Size: to suit roof hatch.

.2 Hatch rail system shall attach to cap flashing of roof hatch and shall not penetrate any roofing materials.

.3 Standard of acceptance:

.1 Bil-Guard 2.0 Hatch Railing System

.2 Maxam Bolt-on Roof Hatch Safety Rail System

.3 Nystom Roof Hatch Safety Railing

.4 Acudor RHSR Safety Rail

.5 or approved equal

.4 Provide one (1) complete fixed hatch railing system for each roof hatch.

2.4 FABRICATION

.1 General: provide hatch assemblies manufactured as integral units ready for installation.

.2 Metal surfaces: for metal surfaces exposed to view in completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

.2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

.1 Coordinate installation of roof hatch with adjacent roofing.

.2 Install products in strict accordance with manufacturer's instructions and approved submittals.

.3 Secure prefabricated curb assembly to structure. Install wood blocking under preformed metal curbs to achieve a minimum height as indicated on drawings.

.4 Coordinate and install exterior flashing. Secure and seal frame to curb. Seal with sealant as specified in Section 07 92 00 – Joint Sealants.

.5 Locate units level, plumb, and in proper alignment with adjacent work.

.1 Test units for proper function and adjust until proper operation is achieved.

.2 Repair finishes damaged during installation.

.3 Restore finishes so no evidence remains of corrective work.

3.3 ADJUSTING AND CLEANING

.1 Adjust doors and hardware, after installation, for proper operation.

.2 Clean exposed surfaces using methods acceptable to manufacturer which will not damage finish.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society of Testing and Materials (ASTM)

- .1 ASTM E72 – Standard Test Methods of Conducting Strength Tests of Panels for Building Construction
- .2 ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials
- .3 ASTM E605/E605M – Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
- .4 ASTM E736 – Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
- .5 ASTM E759 – Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members
- .6 ASTM E761/E761M – Standard Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members
- .7 ASTM E937/E937M – Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
- .8 ASTM G21 – Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

.2 Association of Wall and Ceiling Industry (AWCI)

- .1 AWCI Technical Manual 12A – Standard Practice for the Testing and Inspection of Field Applied Sprayed Fire-Resistive Materials

.3 Underwriters' Laboratories of Canada (ULC)

- .1 ULC 102 – Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
- .2 ULC 263 – Criteria for Use in Extension of Data from Fire Endurance Tests

1.2 QUALITY ASSURANCE

.1 Manufacturers shall specialize in manufacturing products of this section.

.2 Applicator shall be approved, licensed and supervised by the product manufacturer.

.3 Product shall be manufactured under ULC Follow-up Program. Each container or package shall bear ULC label.

.4 Source limitations: obtain fireproofing from single source.

1.3 REGULATORY REQUIREMENTS

.1 Conform to applicable code for fire-resistance rating.

.2 Submit certification of acceptability of fireproofing materials to authority having jurisdiction.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide in accordance with Section 01 33 00, Submittal Procedures.

.2 Sample: submit duplicate 300mm x 300mm size sample of exposed finish of cementitious fireproofing materials.

.3 Shop drawings: framing plans, schedules, or both, indicating the following:

- .1 Extent of fireproofing for each construction and fire-resistance rating.
- .2 Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
- .3 Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
- .4 Treatment of fireproofing after application.

.4 Submit certified copies of test reports verifying fireproofing applied to substrate will meet or exceed requirements of this section.

.5 Submit manufacturer's installation instructions.

1.5 PRODUCT HANDLING AND STORAGE

.1 Deliver packages in original unopened packages, with labels intact, including ULC labels for fire hazard and fire-resistance classifications.

.2 Discard any materials, which have come into contact with contaminants prior to actual use.

1.6 PROJECT/SITE CONDITIONS

.1 Do not apply fireproofing when ambient or substrate temperature is 5ºC or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

.2 Do not apply fireproofing until concrete toppings and/or roofing applications have been installed.

.3 Provide ventilation in areas to receive work of this section in accordance with manufacturer's written instructions, during, and for 24 hours after application.

.4 Maintain relative humidity within limits recommended fireproofing manufacturer.

Part 2 MATERIALS

2.1 GENERAL

.1 Assemblies: provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

.2 Source limitations: obtain fireproofing from single source.

.3 Fire-resistance design: indicated on Drawings, tested according to ASTM E119/UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

.4 Asbestos: provide products containing no detectable asbestos.

2.2 CEMENTITIOUS FIREPROOFING MATERIALS

.1 Cementitious sprayed fireproofing: manufacturer's standard, factory-mixed, asbestos-free, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at site to form slurry or mortar before conveyance and application or conveyed in a dry state and mixed with atomized water at place of application.

.2 ULC certified Portland cement based cementitious fireproofing qualified for use in ULC designs, and conforming to the following requirements:

- .1 Bond strength (ASTM E736): minimum 7.18 kPa.
- .2 Bond impact (ASTM E72): no cracking, flaking or delamination.
- .3 Dry density (ASTM E605): minimum 240kg/m^3.
- .4 Surface burning characteristics (ULC 102):
  - .1 Non-combustible
  - .2 Classification for flame spread: 10 or less
  - .3 Smoke developed: 10 or less
- .5 Thickness: as required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E605, whichever is thicker, but not less than 9mm.
- .6 Compressive strength: in accordance with ASTM E761.
- .7 Corrosion resistance (ASTM E937): no evidence of corrosion.
- .8 Deflection (ASTM E759): no cracking, spalling or delamination.
- .9 Fungi-resistance (ASTM G21): no growth when fungicide used.
- .10 Finish: Contract Administrator to select from manufacturer's full range.

.3 Standard of acceptance:

- .1 Monokote MK-6 Series, GCP Applied Technologies
- .2 AD Southwest Fireproofing Type 5GP, by Southwest Fireproofing
- .3 Cafco 300, by Isolatek International

2.3 AUXILIARY MATERIALS

.1 General: provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

.2 Water: clean, potable.

.3 Substrate primers: primers approved by fireproofing manufacturer and complying with one or both of the following requirements:

.1 Fireproofing manufacturer shall be contacted for procedures on handling primed/painted steel.

.2 Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E736.

.4 Bonding agent: product approved by fireproofing manufacturer and complying with requirements in ULC's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design. Verify compliance with the following:

.1 Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.

.2 Objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.

.3 The installation of ducts, piping, conduit or other suspended equipment shall not take place until the application of the fireproofing is complete in an area.

.2 Fire protection shall not be applied to steel floor decks prior to the completion of concrete work on that deck.

.3 The application of fireproofing to the underside of roof deck shall not commence until the roof is completely installed and tight, all penthouses are complete, all mechanical units have been placed, and construction roof traffic has ceased. When roof traffic is anticipated, as in the case of periodic maintenance, roofing pavers shall be installed as a walkway to distribute loads.

.4 Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

.5 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

.1 Cover other work subject to damage from fallout or overspray of fireproofing materials during application.

.2 Clean substrates of substances that could impair bond of fireproofing.

.3 For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

.1 Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

.2 Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

.3 Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.

.1 Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.

.2 Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

.4 Metal decks:

.1 Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, has been completed.

.2 Do not apply fireproofing to underside of metal roof deck until roofing has been completed; prohibit roof traffic during application and drying of fireproofing.

.3 When roof traffic is anticipated, as in the case of periodic maintenance, roofing pavers shall be installed as a walkway to distribute loads.

.5 Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

.6 Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

.7 Extend fireproofing in full thickness over entire area of each substrate to be protected.

.8 Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

.9 For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply fireproofing that differs in color from that of encapsulant over which it is applied.

.10 Where sealers are used, apply products that are tinted to differentiate them from fireproofing over which they are applied.

.11 Provide a uniform finish.

.12 Cure fireproofing according to fireproofing manufacturer's written recommendations.

.13 Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

3.4 FIELD QUALITY CONTROL

.1 Special inspections: Owner may engage a qualified special inspector to perform the following special inspections:

.1 Test and inspect in accordance with AWCI Manual 12A.

.2 Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

.3 Application will be considered defective if it does not pass tests and inspections.

.1 Remove and replace fireproofing that does not pass tests and inspections, and retest.

.2 Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

.4 Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

.1 Cleaning: immediately after completing spraying operations in each containable area of project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

.2 Protect fireproofing, according to advice of manufacturer and installer, from damage resulting from construction operations or other causes, so fireproofing will be without damage or deterioration at time of Substantial Completion.

.3 As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.

.4 Repair fireproofing damaged by other work before concealing it with other construction.

.5 Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 Association of Wall and Ceiling Industry (AWCI)

.1 AWCI Technical Manual 12-B, Standard Practice for Testing and Inspection of Field Applied Thin-Film Intumescent Fire-Resistive Materials

.2 Steel Structures Painting Council (SSPC)

.1 SSPC Surface Preparation Standards

.3 Underwriters' Laboratories of Canada (ULC)

.1 ULC 101 – Standard Methods of Fire Endurance Tests of Building Construction and Materials

.2 ULC 102 – Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

.3 ULC – List of Equipment and Materials

1.2 QUALITY ASSURANCE

.1 Manufacturers shall specialize in manufacturing products of this section.

.2 Applicator shall be approved, licensed and supervised by the product manufacturer.

.3 Product shall be manufactured under ULC Follow-up Program. Each container or package shall bear ULC label.

1.3 REGULATORY REQUIREMENTS

.1 Conform to applicable code for fire-resistance rating.

.2 Submit certification of acceptability of fireproofing materials to authority having jurisdiction.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide in accordance with Section 01 33 00, Submittal Procedures.

.2 Submit copies of fire test reports of fireproofing application to substrate materials required.

.3 Shop drawings:

.1 Submit shop drawings indicating proposed material, reinforcement, anchorage, fastenings and method of installation. Construction details shall accurately reflect actual job conditions.

.2 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions sufficient for identification at job site. Include manufacturer's printed instructions for installation, and ULC service assembly number.

.4 Submit manufacturer's installation instructions.

1.5 PRODUCT HANDLING AND STORAGE

.1 Deliver and store materials in a dry, protected area, off ground in original, undamaged, sealed containers with manufacturer's labels and seals intact, at temperatures between 10°C and 40°C.

.2 Discard any materials, which have come into contact with contaminants prior to actual use.

1.6 PROJECT/SITE CONDITIONS

.1 Do not apply sprayed intumescent fireproofing when temperature of substrate and surrounding air is below 10°C.

.2 Do not apply intumescent fireproofing until concrete toppings and/or roofing applications have been installed.

.3 Provide ventilation in areas to receive Work of this Section, during, and for 24 hours after application.

.4 Relative humidity must not exceed 80% throughout the total period of application and drying for the intumescent fireproofing. Surface to be coated shall not be less than 3°C above the dewpoint.

1.7 SEQUENCING AND SCHEDULING

.1 Sequence Work in conjunction with ceiling hanger tabs, mechanical and electrical.

.2 Steel surfaces with less than 1m clear working access may necessitate applying material to inaccessible surfaces prior to erection of the finished steel members, either at the point of fabrication or on-site.

Part 2 MATERIALS

2.1 MATERIALS

.1 Intumescent fireproofing: ULC labelled and listed qualified for use in ULC Designs specified. Standard of acceptance: 3M FireDam Intumescent Coating WB 1000, or approved equal.

.2 Primer: as recommended by intumescent fireproofing manufacturer.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Examine surfaces to receive Work of this Section and report to the Contractor, in writing, defects of Work prepared by other trades and unsatisfactory site and/or environmental conditions. Identification marking of the steel components must be by wax crayon to facilitate ease of removal.

.2 Verify that substrate surfaces are ready to receive Work. Weld flashes should be ground smooth prior to commencement of application.

.3 Verify that all clips, hangers, sleeves and similar devices have been attached.

.4 Ensure that ducts, piping, equipment, or other items, which would interfere with application of fireproofing, are not positioned until sprayed fireproofing Work is completed.

.5 Confirm compatibility of surfaces to receive fireproofing materials. Steel surfaces shall be primed with a compatible red oxide primer.

.6 Commencement of Work means acceptance of substrate.

3.2 PREPARATION

.1 Substrate shall be free of material, which would impair bond. Ensure surfaces are dry, clean, and free from oil, grease, dirt, loose paint, mill scale or other deleterious materials.

.2 Protect adjacent surfaces and equipment from overspray of sprayed materials.

3.3 APPLICATION

.1 Thoroughly mix the intumescent fireproofing in accordance with manufacturer's instructions and apply in sufficient thickness to achieve rating with as many passes as necessary to cover with, uniform in texture.

.2 To ensure even coating thickness, apply successive coats of fire proofing of no more than 500 microns dft (760 microns wft) per coat.

.3 Apply intumescent fireproofing to provide a fire-resistance rating to correspond with tested assemblies.

.4 Allow sufficient drying time in accordance with manufacturer's recommendations.

3.4 PATCHING

.1 Patch and repair damage to fireproofing caused by testing, or by other trades, before fireproofing is concealed, or if exposed, before final inspection.

3.5 CLEAN-UP

.1 Remove fireproofing from materials and surfaces not specifically required to be fireproofed. Remove excess material, overspray, droppings and debris.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society of Testing and Materials (ASTM)

- .1 ASTM E72 – Standard Test Methods of Conducting Strength Tests of Panels for Building Construction
- .2 ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials
- .3 ASTM E605/E605M – Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
- .4 ASTM E736 – Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
- .5 ASTM E759 – Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members
- .6 ASTM E761/E761M – Standard Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members
- .7 ASTM E937/E937M – Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
- .8 ASTM G21 – Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

.2 Association of Wall and Ceiling Industry (AWCI)

- .1 AWCI Technical Manual 12A – Standard Practice for the Testing and Inspection of Field Applied Sprayed Fire-Resistive Materials

.3 Underwriters' Laboratories of Canada (ULC)

- .1 ULC 102 – Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
- .2 ULC 263 – Criteria for Use in Extension of Data from Fire Endurance Tests

1.2 QUALITY ASSURANCE

.1 Manufacturers shall specialize in manufacturing products of this section.

.2 Applicator shall be approved, licensed and supervised by the product manufacturer.

.3 Product shall be manufactured under ULC Follow-up Program. Each container or package shall bear ULC label.

.4 Source limitations: obtain fireproofing from single source.

1.3 REGULATORY REQUIREMENTS

.1 Conform to applicable code for fire-resistance rating.

.2 Submit certification of acceptability of fireproofing materials to authority having jurisdiction.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide in accordance with Section 01 33 00, Submittal Procedures.

.2 Sample: submit duplicate 300mm x 300mm size sample of exposed finish of cementitious fireproofing materials.

.3 Shop drawings: framing plans, schedules, or both, indicating the following:

- .1 Extent of fireproofing for each construction and fire-resistance rating.
- .2 Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
- .3 Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
- .4 Treatment of fireproofing after application.

.4 Submit certified copies of test reports verifying fireproofing applied to substrate will meet or exceed requirements of this section.

.5 Submit manufacturer's installation instructions.

1.5 PRODUCT HANDLING AND STORAGE

.1 Deliver packages in original unopened packages, with labels intact, including ULC labels for fire hazard and fire-resistance classifications.

.2 Discard any materials, which have come into contact with contaminants prior to actual use.

1.6 PROJECT/SITE CONDITIONS

.1 Do not apply fireproofing when ambient or substrate temperature is 5ºC or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

.2 Do not apply fireproofing until concrete toppings and/or roofing applications have been installed.

.3 Provide ventilation in areas to receive work of this section in accordance with manufacturer's written instructions, during, and for 24 hours after application.

.4 Maintain relative humidity within limits recommended fireproofing manufacturer.

Part 2 MATERIALS

2.1 GENERAL

.1 Assemblies: provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

.2 Source limitations: obtain fireproofing from single source.

.3 Fire-resistance design: indicated on Drawings, tested according to ASTM E119/UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

.4 Asbestos: provide products containing no detectable asbestos.

2.2 CEMENTITIOUS FIREPROOFING MATERIALS

.1 Cementitious sprayed fireproofing: manufacturer's standard, factory-mixed, asbestos-free, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at site to form slurry or mortar before conveyance and application or conveyed in a dry state and mixed with atomized water at place of application.

.2 ULC certified Portland cement based cementitious fireproofing qualified for use in ULC designs, and conforming to the following requirements:

- .1 Bond strength (ASTM E736): minimum 7.18 kPa.
- .2 Bond impact (ASTM E72): no cracking, flaking or delamination.
- .3 Dry density (ASTM E605): minimum 240kg/m^3.
- .4 Surface burning characteristics (ULC 102):
  - .1 Non-combustible
  - .2 Classification for flame spread: 10 or less
  - .3 Smoke developed: 10 or less
- .5 Thickness: as required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E605, whichever is thicker, but not less than 9mm.
- .6 Compressive strength: in accordance with ASTM E761.
- .7 Corrosion resistance (ASTM E937): no evidence of corrosion.
- .8 Deflection (ASTM E759): no cracking, spalling or delamination.
- .9 Fungi-resistance (ASTM G21): no growth when fungicide used.
- .10 Finish: Contract Administrator to select from manufacturer's full range.

.3 Standard of acceptance:

- .1 Monokote MK-6 Series, GCP Applied Technologies
- .2 AD Southwest Fireproofing Type 5GP, by Southwest Fireproofing
- .3 Cafco 300, by Isolatek International

2.3 AUXILIARY MATERIALS

.1 General: provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

.2 Water: clean, potable.

.3 Substrate primers: primers approved by fireproofing manufacturer and complying with one or both of the following requirements:

.1 Fireproofing manufacturer shall be contacted for procedures on handling primed/painted steel.

.2 Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E736.

.4 Bonding agent: product approved by fireproofing manufacturer and complying with requirements in ULC's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design. Verify compliance with the following:

.1 Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.

.2 Objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.

.3 The installation of ducts, piping, conduit or other suspended equipment shall not take place until the application of the fireproofing is complete in an area.

.2 Fire protection shall not be applied to steel floor decks prior to the completion of concrete work on that deck.

.3 The application of fireproofing to the underside of roof deck shall not commence until the roof is completely installed and tight, all penthouses are complete, all mechanical units have been placed, and construction roof traffic has ceased. When roof traffic is anticipated, as in the case of periodic maintenance, roofing pavers shall be installed as a walkway to distribute loads.

.4 Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

.5 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

.1 Cover other work subject to damage from fallout or overspray of fireproofing materials during application.

.2 Clean substrates of substances that could impair bond of fireproofing.

.3 For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

.1 Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

.2 Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

.3 Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.

.1 Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.

.2 Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

.4 Metal decks:

.1 Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, has been completed.

.2 Do not apply fireproofing to underside of metal roof deck until roofing has been completed; prohibit roof traffic during application and drying of fireproofing.

.3 When roof traffic is anticipated, as in the case of periodic maintenance, roofing pavers shall be installed as a walkway to distribute loads.

.5 Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

.6 Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

.7 Extend fireproofing in full thickness over entire area of each substrate to be protected.

.8 Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

.9 For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply fireproofing that differs in color from that of encapsulant over which it is applied.

.10 Where sealers are used, apply products that are tinted to differentiate them from fireproofing over which they are applied.

.11 Provide a uniform finish.

.12 Cure fireproofing according to fireproofing manufacturer's written recommendations.

.13 Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

3.4 FIELD QUALITY CONTROL

.1 Special inspections: Owner may engage a qualified special inspector to perform the following special inspections:

.1 Test and inspect in accordance with AWCI Manual 12A.

.2 Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

.3 Application will be considered defective if it does not pass tests and inspections.

.1 Remove and replace fireproofing that does not pass tests and inspections, and retest.

.2 Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

.4 Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

.1 Cleaning: immediately after completing spraying operations in each containable area of project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

.2 Protect fireproofing, according to advice of manufacturer and installer, from damage resulting from construction operations or other causes, so fireproofing will be without damage or deterioration at time of Substantial Completion.

.3 As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.

.4 Repair fireproofing damaged by other work before concealing it with other construction.

.5 Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 This section includes firestopping for through-penetrations and joints in or between the following fire-resistance rated assemblies, including both blank openings, linear openings, and openings containing penetrating items:

- .1 Floor-ceiling assemblies,
- .2 Roof-ceiling assemblies,
- .3 Walls and partitions,
- .4 Smoke barriers,
- .5 Construction enclosing compartmentalized areas,
- .6 Firewalls.

1.2 PERFORMANCE CRITERIA

.1 Fire Test Requirements:

- .1 Underwriters' Laboratories of Canada (ULC)
  - .1 ULC 101 – Fire Endurance Tests of Building Construction and Materials
  - .2 ULC 102 – Method of Test for Surface Burning Characteristics of Building Materials
  - .3 ULC 115 – Fire Tests for Fire Stop Systems

.2 Reference Standards

- .1 Underwriters' Laboratories of Canada (ULC) "Firestop Systems and Components"
  - .1 Firestop Systems (XHEZC)
  - .2 Firestop Components (XHJZC)
- .2 Underwriters Laboratories of Northbrook, IL "Products Certified for Use in Canada".
  - .1 Through Penetration Firestop Systems (XHEZ7)
  - .2 Joint Systems (XHBN7)
  - .3 Fill, Void or Cavity Materials (XHHW7)
  - .4 Firestop Devices (XHJI7)
  - .5 Forming Materials (XHKU7)
  - .6 Wall Opening Protective Materials (CLIV7)
- .3 National Building Code of Canada (NBC)
- .4 National Research Council Canada (NRC), "Best Practice Guide on Fire Stops and Fire and their Impact on Sound Transmission" (NRCC-49677).
- .5 Factory Mutual Approvals (FM) of Norwood, MA "FM 4991: Standard for Approval of Firestop Contractors".

.3 American Society for Testing and Materials (ASTM)

.1 ASTM E2174 – Standard Practice for On-Site Inspection of Installed Fire Stops,

.2 ASTM E2393 – Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers,

.3 ASTM G21 – Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

.4 International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments

1.3 PERFORMANCE REQUIREMENTS

.1 Provide products that upon curing do not re-emulsify, dissolve, leach, breakdown, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during and after construction.

.2 When intumescent products are used, provide products that do not contain sodium silicate or any other water soluble intumescent ingredient in the formulation.

.3 Provide firestop products that do not contain ethylene glycol.

.4 Provide firestop sealants sufficiently flexible to accommodate motion such as pipe vibration, water hammer, thermal expansion and other normal building movement without damage to the seal.

.5 Pipe insulation shall not be removed, cut away or otherwise interrupted through wall or floor openings. Provide products appropriately tested for the thickness and type of insulation utilized.

.6 Fire rated pathway devices shall be the preferred product and shall be installed in all locations where frequent cable moves, add-ons and changes will occur. Such devices shall be:

.1 Capable of retrofit around existing cables

.2 Designed such that two or more devices can be ganged together

.3 Maintenance free such that no action is required to activate the smoke and fire sealing mechanism

.7 When mechanical cable pathways are not practical, openings within walls and floors designed to accommodate voice, data and video cabling shall be provided with re-enterable products specifically designed for retrofit.

.8 Provide fire-resistive joint sealants sufficiently flexible to accommodate movement such as thermal expansion and other normal building movement without damage to the seal.

.9 Provide fire-resistive joint sealants designed to accommodate a specific range of movement and tested for this purpose in accordance with a cyclic movement test criteria as outlined in ULC 115.

.10 Provide penetration firestop systems, fire-resistive joint systems, or perimeter fire barrier systems subjected to an air leakage test conducted in accordance with Standard, ULC 115 with published L-Ratings for ambient and elevated temperatures as evidence of the ability of firestop system to restrict the movement of smoke.

.11 Provide T-Rating Collar Devices tested in accordance with ULC 115 for metallic pipe penetrations requiring T-Ratings per the applicable building code.

.12 Provide a fire-rated grommet for all individual or small grouped cable applications up to 0.53 in. (14mm).

.13 Provide moisture-curing products where inclement weather or greater than transient water exposure is expected.

.14 Penetrations or joints in Fire Resistance Rated Walls: Provide firestopping with ratings determined in accordance with ULC 115.

.1 F-Rating: Not less than the assigned time for the fire-resistance rating of the wall construction being penetrated, unless otherwise indicated.

.2 FT-Rating: Not less than the assigned time for the fire-resistance rating and temperature (thermal) rise on the non-fireside of the vertical assembly.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide samples and shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

.2 Provide product data for each type of firestopping product indicated. Include manufacturer's specifications and technical data for each material including the composition and limitations, documentation of ULC or cUL firestop systems to be used, and manufacturer's installation instructions.

.3 Provide manufacturer's engineering judgment identification number and drawing details when no ULC or cUL system is available for an application. Engineering judgment must include both project name and contractor’s name who will install firestop system as described in drawing.

.4 Submit material safety data sheets provided with product delivered to job-site.

.5 Samples: submit duplicate 300mm x 300mm (12” x 12”) samples showing actual firestop material proposed for project.

.6 Shop drawings:

.1 Submit documentation from a qualified third-party testing agency that is applicable to each firestopping system configuration for construction, joint opening width and/or penetrating items.

.2 Submit shop drawings indicating proposed material, reinforcement, anchorage, fastenings and method of installation. Construction details shall accurately reflect actual job conditions.

.3 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions sufficient for identification at job site. Include manufacturer's printed instructions for installation, and ULC service assembly number.

.4 Submit Certificate of Conformance signed by manufacturers of firestopping products certifying that products comply with requirements.

1.5 QUALITY ASSURANCE

.1 Provide firestopping systems that comply with the following requirements and those specified in "Performance Criteria" Article:

.1 Firestopping tests are performed by a qualified, testing and inspection agency. A qualified testing and inspection agency is ULC or UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.

.2 Firestopping products bear classification marking of qualified testing and inspection agency.

.2 Obtain firestop systems for each type of penetration or joint opening and construction condition indicated from a single manufacturer.

.3 Conduct a start-up meeting at the Project site to comply with requirements in Division 1 Section "Project Meetings".

.4 A manufacturer's direct representative (not distributor or agent) shall be on-site during initial installation of firestop systems to ensure the contractor personnel are appropriately trained in proper selection and installation procedures. This shall be done per manufacturer's written recommendations published in their literature and drawing details.

.5 Firestop system installation shall meet requirements of ULC 115 or UL 2079 tested assemblies that provide a fire rating as required.

.6 Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

.7 Firestop Systems do not re-establish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

.8 For those firestop applications that exist for which no ULC or cUL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar ULC or cUL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by the International Firestop Council.

.9 Upon completion of the work, provide written certification that the installation of the firestopping was completed in accordance with the project drawings and specifications, and applicable standards and codes.

1.6 INSTALLER QUALIFICATIONS

.1 Engage an experienced installer who is certified, licensed, FM Approved in accordance with FM 4991, Certified by UL and/or ULC as a Qualified Contractor, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install firestop products per specified requirements. A manufacturer's willingness to sell its firestopping products to Contractor or to an installer engaged by Contractor does not in itself confer qualifications on buyer.

.2 The work shall be installed by a contractor with at least one (1) of the following qualifications:

.1 FM 4991 Approved Contractor,

.2 ULC Approved Contractor,

.3 Manufacturer Accredited Fire Stop Specialty Contractor,

.4 Installer shall have not less than three (3) years' experience with fire stop installation.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver firestopping products to Project site in original, unopened containers or packages with intact and legible manufacturer's labels identifying product and manufacturer, date of manufacture; lot number; shelf life, if applicable; qualified testing and inspection agency's classification marking; and mixing instructions for multi-component materials.

.2 Store and handle materials for firestopping products to prevent their deterioration or damage due to moisture, temperature changes, contaminants or other causes.

.3 Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

.4 Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

.5 Do not use damaged, frozen or expired materials.

1.8 PROJECT CONDITIONS

.1 Do not install firestopping products when ambient or substrate temperatures are outside limitations recommended by manufacturer.

.2 Do not install firestopping products when substrates are wet due to rain, frost, condensation, or other causes.

.3 Do not use materials that contain flammable solvents.

.4 Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

1.9 COORDINATION

.1 Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

.2 Coordinate sizing of sleeves, openings, core-drilled holes or cut openings to accommodate through-penetration firestop systems.

.3 Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

.4 Schedule installation of Drop-In firestop devices after placement of concrete but before installation of the pipe penetration. Diameter of sleeved or cored hole to match the listed system for the device

.5 Schedule installation of preformed joint materials to be installed with the metal framing

1.10 REVIEW

.1 Notify Contract Administrator to permit review prior to concealing or enclosing firestopping materials and service penetration assemblies.

.2 Retain on the job site, used containers of materials applied in the various penetrations for review.

.3 Prepare appropriate schedule where more than one (1) firestop system is required.

1.11 WARRANTY

.1 The manufacturer and the installer shall provide a written warranty on the firestopping work for two (2) years.

Part 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

.1 Subject to compliance with through penetration firestop systems and joint systems listed in the ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory, provide products of the following manufacturers as identified below:

.1 3M Fire Protection Products as distributed by:

.1 Brock White Canada Ltd.

.2 Nu-West Construction Products Inc.

.2 Hilti Fire Stop Systems as distributed by:

.1 1-801 Century Street, Winnipeg, MB

.3 Specified Technologies Inc. (STI), SpecSeal firestop products, as distributed by:

.1 The Bolt Supply House Ltd.

.2 Foundation Building Materials

.4 Rectorseal, Metacaulk firestop products as distributed by:

.1 Canadian Thermal Technologies

.5 Tremco firestop products, as distributed by:

.1 Wearing Williams Ltd.

.6 Johns Mansville firestop products

.2 General:

.1 Use only firestop products that have been ULC or cUL tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

.2 Materials shall be asbestos-free and systems shall be capable of maintaining an effective barrier against flame, smoke, and gases, in compliance with requirements of ULC 115, and not to exceed opening sizes for which they are intended.

.3 Provide firestopping products that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by firestopping products manufacturer based on testing and field experience.

.4 Provide components for each firestopping system that are needed to install fill materials. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

.5 Firestop system rating: see plans.

.6 Service penetration assemblies: certified by ULC in accordance with ULC 115 and listed in ULC Guide No. 40 U19.

.7 Service penetration firestop components: certified by ULC in accordance with ULC 115 and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15 under the Label Service of ULC.

.8 Fire-resistance rating of installed firestopping assembly not less than the fire-resistance rating of surrounding floor and wall assembly.

.9 Firestopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal; do not use cementitious or rigid seal at such locations.

.10 Firestopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal; do not use cementitious or rigid seal at such locations.

.11 Primers: to manufacturer's recommendations for specific material, substrate and end use.

.12 Water (if applicable): potable, clean, and free from injurious amounts of deleterious substances.

.13 Damming and back-up materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.14 Sealants for vertical joints: non-sagging.

.15 L-rating: not exceeding 5.0 cfm/sq. ft. of penetration opening at both ambient and elevated temperatures.

.16 Mould resistance: provide penetration firestopping with mould and mildew resistance rating of 0 as determined by ASTM G21.

.17 For penetrations through a Firewall, provide a firestop system with a "FT" Rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated. All thermal insulation utilized around pipe penetrations to be wrapped with mineral wool insulation as indicated in the firestop system and/or engineered judgement. All FT-Rated firestop systems utilizing pipe insulation shall incorporate in addition, the following to the system:

.1 All Levels – Vertical Firewall (2-hour FRR)

.1 Metallic Plumbing Pipes – wrapped with mineral wool and covered with canvas jacket or thermal ceramic wrap.

.2 Electrical Cables & Conduits

2.2 APPLICATIONS

.1 General: Use only firestopping products that have been tested for specific fire-resistance-rated construction conditions conforming to construction assembly type, penetrating item type or joint opening width and movement capabilities, annular space requirements, and fire-rating involved for each separate instance.

.2 Provide backing material of type determined by appropriate manufacturer's ULC listing for specific firestop application.

.3 Elastomeric firestop sealant: silicone based elastomeric firestop sealant (either non-sag or self-levelling depending on vertical or horizontal application) tested to ULC 115. Standard of acceptance:

.1 Intumescent firestop sealant: one part intumescent firestop sealant.

.2 Intumescent firestop blocks: pre-formed intumescent firestop blocks.

.3 Intumescent firestop collars: pre-assembled intumescent firestop collars.

.4 Pre-Installed firestop devices for use with non-combustible and combustible pipes (closed and open systems), conduit and/or cable bundles penetrating concrete floors and/or gypsum walls.

.5 Re-penetrable, cable management devices for use with new or existing cable bundles penetrating gypsum or masonry walls.

.6 Intumescent Sealants: Single component intumescent latex formulations containing no water soluble intumescent ingredients capable of expanding a minimum 8 times.

.7 Endothermic Sealants: Single component latex formulations that upon cure do not re-emulsify during exposure to moisture.

.8 Elastomeric Sealants: Single component latex formulations that upon cure do not re-emulsify during exposure to moisture and accommodate minimum ±25 percent movement.

.9 Firestop Devices: Factory-assembled steel collars lined with intumescent material capable of expanding a minimum 30 times sized to fit specific outside diameter of penetrating item.

.10 Fire Rated Cable Pathways: Gangable device modules capable of being retrofitted around existing cables and comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill and requiring no additional action in the form of plugs, twisting closure, putty, pillow, or sealant to achieve fire and leakage ratings.

.11 Wall Opening Protective Materials: Intumescent, non-curing pads or inserts for protection of electrical switch and receptacle boxes to reduce horizontal separation to less than 24” (610 mm).

.12 Firestop Putty: Intumescent, 100% solids, non-hardening, water resistant, butyl rubber based putties containing no solvents or silicone compounds.

.13 Wrap Strips: Single component intumescent elastomeric strips faced on both sides with a plastic film and capable of expanding a minimum 30 times.

.14 Firestop Pillows: Re-enterable, non-curing, mineral fiber core encapsulated with an intumescent coating on all six sides contained in a flame retardant poly bag.

.15 Mortar: Portland cement based dry-mix product formulated for mixing with water at Project site to form a non-shrinking, water-resistant, homogenous mortar.

.16 Silicone Sealants: Moisture curing, single component, silicone elastomeric sealant for horizontal surfaces (pourable or nonsag) or vertical surface (nonsag).

.17 All-Weather Coatings: Moisture curing, single component silicone copolymer elastomeric spray coatings for horizontal surfaces where greater water resistance is required or inclement weather is anticipated.

.18 Silicone Foam: Multicomponent, silicone-based liquid elastomers, that when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

.19 Composite Sheet: Intumescent material sandwiched between a galvanized steel sheet and steel wire mesh protected with aluminum foil capable of sustaining a minimum 2,500 lbs (1,134 kg) when subjected to load testing.

.20 Cast-In-Place Firestop Device: Single component molded firestop device installed on forms prior to concrete placement with totally encapsulated, tamper-proof integral firestop system and smoke sealing gasket.

.21 Fire-Rated HVAC Retaining Angles: Steel angle system with integral intumescent firestop gasket for use on steel HVAC ducts.

.22 Firestop Plugs: Re-enterable, foam rubber plug impregnated with intumescent material capable of expanding minimum 10 times with expansion beginning at 350°F (177°C) for use in blank openings and cable sleeves.

.23 Fire-Rated T Rating Collar Device: Louvered steel collar system with synthetic aluminized polymer coolant wrap installed on metallic pipes where T Ratings are required by applicable building code requirements.

.24 Fire-Rated Cable Grommet: Molded two-piece grommet made from plenum grade polymer with a foam inner core for sealing cable penetrations up to 0.53 in. (14 mm) diameter.

.25 Fire-Rated Closet Flange Gasket: Molded, single-component, intumescent gasket for use beneath a closet flange in floor applications.

Part 3 EXECUTION

3.1 INSTALLER CERTIFICATION

.1 Installers shall be approved and certified by the acceptable manufacturer's representative and shall have certification cards and manufacturer's ULC listings on site.

.2 Acceptable Firestop Contractors:

.1 National Firestop Ltd.
.2 Total Firestop Systems Ltd.
.3 Western Industrial Services Ltd.
.4 Secure Firestop Ltd.
.5 Penta Protective Coatings Ltd.
.6 Eco-Lok Protective Coatings
.7 Advanced Insulation Inc.
.8 Gunnlaughson Spray-On

3.2 PREPARATION

.1 Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

.2 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and free of dirt, grease, oil, scale, laitance, rust, release agents, water repellents, frost and any other substances that may inhibit optimum adhesion.

.3 Prepare surfaces in contact with firestopping materials and smoke seals to manufacturer's instructions.

.4 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.

.5 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

.6 Remove all existing material from around annular spaces and existing service penetrations and/or along existing joints to suit manufacturer's recommendations and the requirements as indicated in the Firestop System

.7 Ensure substrate is structurally stable. Remove all loose material, such as masonry, hollow clay tile, plaster, etc., from the opening and joint. Provide new material to down-size or to make the surface flush and structurally sound to accept the new Firestop System.

.8 Score and enlarge annular spaces around service penetrations and along joints to suit manufacturer's requirements and Firestop System.

.9 Down-size oversized openings with appropriate material to match existing, such as rated gypsum-board, firestop mortar or some other method that maintains the continuity of the horizontal and/or vertical fire separation and the new installed Firestop System.

.10 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.

.11 Prepare surfaces in contact with firestopping materials and smoke-seals to manufacturer's instructions.

.12 Maintain insulation around pipes and ducts penetrating fire separations. Confirm that fire stop system has been tested with actual pipe or duct insulation penetrating the fire separation, as indicated in the approved ULC or cUL Firestop System.

.13 Replace or repair damaged insulation and covers (jackets) around existing penetrations at horizontal and/or vertical fire separations a minimum 300mm past the separation. Tie/tape new insulation and covers (jackets) into the existing with appropriate material.

.14 Do not proceed until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

.1 Install firestopping and smoke seal material and components in accordance with acceptable manufacturer's ULC listings and instructions.

.2 Seal holes or voids made by through penetrations, poke-through termination devices, and un-penetrated openings or joints to ensure continuity and integrity of fire separations are maintained.

.3 Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of through-penetration firestop systems that might hamper the performance of fire dampers as it pertains to duct work.

.4 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.5 Tool or trowel exposed surfaces to a neat finish.

.6 Protect materials from damage on surfaces subjected to traffic.

.7 Apply a suitable bond-breaker to prevent three-sided adhesion in applications where this condition might occur such as the intersection of a gypsum wallboard/steel stud wall to floor or roof assembly where the joint is backed by a steel ceiling runner or track.

.8 Where joint application is exposed to the elements, fire-resistive joint sealant must be approved by manufacturer for use in exterior applications.

3.4 FIELD QUALITY CONTROL

.1 Inspections: The City shall engage a qualified independent inspection agency to inspect through-penetration firestop systems in accordance with ASTM E2174, “Standard Practice for On Site Inspection of Installed Fire Stops” or joint systems in accordance with ASTM E2393, “Standard Practice for On Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers”. NOTE: Manufacturers are not qualified inspection agencies, and it is a conflict of interest for the manufacturer to perform inspections of installed firestopping systems according to the aforementioned inspection standards.

.2 Keep areas of work accessible until inspection by authorities having jurisdiction.

.3 Where deficiencies are found, repair or firestopping products so they comply with requirements.

3.5 SCHEDULE

.1 Firestop and smoke seal at:

- .1 Penetrations through fire-resistance rated masonry, concrete and gypsum board partitions and walls
- .2 Top of fire-resistance rated masonry and gypsum board partitions
- .3 Intersection of fire-resistance rated masonry and gypsum board partitions
- .4 Control joints in fire-resistance rated masonry and gypsum board partitions and walls
- .5 Penetrations through fire-resistance rated floor slabs, ceilings and roofs
- .6 Openings and sleeves installed for future use through fire separations
- .7 Around mechanical and electrical assemblies penetrating fire separations

.8 Rigid ducts: greater than 129cm^2 (20in^2): firestopping to consist of bead of firestopping materials between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation

3.6 ADJUSTING AND CLEANING

.1 Remove equipment, materials and debris, leaving area in undamaged, clean condition.

.2 Clean all surfaces adjacent to sealed openings to be free of excess firestopping materials and soiling as work progresses.

.3 Remove excess materials and debris and clean adjacent surfaces immediately after application.

.4 Remove temporary dams after initial set of firestopping and smoke seal materials.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB)

.1 CGSB 19-GP-5M – Sealing Compound, One Component, Acrylic Base, Solvent Curing

.2 CAN/CGSB-19.13 – Sealing Compound, One Component, Elastomeric, Chemical Curing

.3 CGSB 19-GP-14M – Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing

.4 CAN/CGSB-19.17 – One Component Acrylic Emulsion Base Sealing Compound

.5 CAN/CGSB-19.24 – Multi component, Chemical-Curing Sealing Compound

1.2 QUALIFICATIONS

.1 Installation of sealant and caulking Work shall be carried out by a recognized specialized applicator having skilled mechanics, thoroughly trained and competent in all phases of caulking Work, with at least five (5) years experience.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver all materials to the job site in their original unopened containers, with all labels intact.

.2 Store materials in strict accordance with manufacturer's recommendations.

1.4 ENVIRONMENTAL CONDITIONS

.1 Apply sealants only to completely dry surfaces, and at air and material temperatures above minimum established by manufacturer's specifications.

1.5 WARRANTY

.1 Contractor hereby warrants that caulking Work will not leak, crack, crumble, melt, shrink, run, lose adhesion or stain adjacent surfaces for three (3) years.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Primers: type recommended by sealant manufacturer.

.2 Joint fillers (for use with sealants):

.1 General: compatible with primer and sealants, outsized 30% to 50%

.2 Polyethylene, urethane, neoprene or vinyl: extruded closed cell foam, Shore A hardness 20, tensile strength 140kPa to 200kPa

.3 Neoprene or butyl rubber: round solid rod, Shore A hardness 70

.4 Polyvinyl chloride or neoprene: extruded tubing with 6mm (1/4") minimum thick walls

.3 Joint-filler sealant: Emseal bitumen impregnated foam, regular, self-adhesive, oversize 50%.

.4 Filler for masonry control joints (refer to spec. detail 4.2): Permastik 2220 expanded polyethylene closed cell.

.5 Bond breaker: pressure sensitive plastic tape, which will not bond to sealants.

.6 Sealants – exterior:

.1 Type 1: Dow Corning 790 Silicone Building Sealant, or G.E. Silpruf SCS2000. Use at all exterior locations, except where another type is specified. Colour to be selected.

.2 Type 2: Tremco THC-900, Vulkem 116 and 45, Bostik Chemcalk 915/950, and Sonneborn SL-2. Use for filler in saw cuts, expansion joints and traffic joints in horizontal concrete slabs, self-levelling.

.7 Sealants – interior:

.1 Type 1, paintable silicone: Dow Corning 8644 or G.E. Acrylasil 1302 to interior joints between door and window frame and adjacent construction, translucent silicone to plastic laminate counters and backsplashes. Use at all interior locations except where another type is specified.

.2 Type 2, silicone, one part: Dow Corning 786, G.E. 1700 tub caulk, mildew resistant. Use for fixtures, bathtubs, and vanity tops, colour to be selected.

.8 Cleaning material for surfaces to receive sealant: Xylol, Methylethyleketon (MEK), Toluol, or as recommended by the manufacturer of sealant.

.9 Energy sealant: foam-in-place urethane. Acceptable products: Polycel One as manufactured by W.R. Grace and Co. or Insta-Seal by Insta-Foam Products, Inc.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verify at the site that joints and surfaces have been provided as specified under the Work of other Sections; and that joint conditions will not adversely affect execution, performance or quality of completed Work; and that they can put into acceptable condition by means of preparation specified in this Section.

.2 Ascertain that sealers and coatings applied to sealant substrates are compatible with sealant used and that full bond between the sealant and substrate is attained. Request samples of the sealed or coated substrate from their fabricators for testing of compatibility and bond, if necessary, or test on site to Contract Administrator's acceptance.

.3 Verify that specified environmental conditions are ensured before commencing Work.

.4 Ensure that releasing agents, coatings or other treatments have either not been applied to joint surfaces, or that they are entirely removed.

.5 Defective Work resulting from application to unsatisfactory joint conditions will be considered the responsibility of those performing the Work of this Section.

3.2 PREPARATION

.1 Remove dust, paint, loose mortar and other foreign matter, and dry joint surfaces.

.2 Remove rust, silt, scale and coatings from ferrous metals by wire brush, grinding or sandblasting.

.3 Remove oil, grease and other coatings from non-ferrous metals with Xylol, Toluol or MEK.

.4 Prepare concrete, masonry, glazed and vitreous surfaces as recommended by sealant manufacturer.

.5 Examine joint sizes and correct to achieve proper width/depth ratio:

- .1 6mm x 6mm (1/4" x 1/4") – minimum joint size
- .2 6mm to 13mm (1/4" to 1/2") – depth shall equal width
- .3 13mm to 25mm (1/2" to 1") – depth shall equal half of width
- .4 25mm to 50mm (1" to 2") – maximum sealant depth to be 13mm (1/2")
- .5 For joints wider than 50mm (2"), the sealant manufacturer's representative shall be contacted.

.6 Install joint-filler or apply bond breaker tape to achieve correct joint depth.

.7 Where necessary to prevent staining, mask adjacent surfaces with tape prior to priming and/or caulking.

.8 Prime sides of joint in accordance with manufacturer's directions, immediately prior to caulking.

.9 Before any sealing is commenced, a test of the material shall be made for indications of staining or poor adhesion.

3.3 APPLICATION SEALANTS

.1 Apply sealants in accordance with manufacturer's directions, using a gun with proper size nozzle. Use sufficient pressure to fill voids and joints solid.

.2 Form surface of the sealant with full bead, smooth, free from ridges, wrinkles, sags and droppings using recommended cleaners as Work progresses. Remove masking tape immediately after tooling of joints.

.3 Superficial pointing with the skin bead is not acceptable.

3.4 APPLICATION ENERGY SEALANT

.1 Apply foamed-in-place sealant in strict accordance with manufacturer's specifications.

.2 Apply to fill gaps in insulation and to prevent infiltration at exterior insulation envelope to maintain air/vapour barrier and insulation envelope.

.3 Apply foam at:

.1 Plumbing pipe, electrical and duct penetrations
.2 Gap between door frames and wall in contact with insulation
.3 Gap between window frames and wall in contact with insulation

3.5 APPLICATION JOINT-FILLER SEALANT

.1 Apply joint-filler sealant for seal between:

.1 Bottom of exterior hollow metal frame and concrete
.2 Underside of exterior door threshold to concrete

3.6 SCHEDULE

.1 Examine drawings and specification details.

.2 Sealing not specified elsewhere shall be the following:

.1 Joints between dissimilar materials
.2 Sealing at plumbing fixture bases to floor
.3 Sealing at vanities to walls
.4 Sealing at exposed beads where gypsum board meets dissimilar materials
.5 Remedial sealing on interior, only where authorized
.6 Sealing at base of door frames to flooring, except at carpet

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)

.1 Architectural Woodwork Standards

.2 Canadian Standards Association (CSA)

.1 CSA O112.10 – Evaluation of adhesives for structural wood products (limited moisture exposure)

.2 CSA O122 – Structural glued-laminated timber

.3 CAN/CSA O141 – Softwood Lumber

.4 CAN/CSA O80 Series – Wood Preservation

.3 National Hardwood Lumber Association (NHLA)

.1 Rules for the Measurement and Inspection of Hardwood and Cypress

.4 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber

.5 North American Architectural Woodwork Standards

.1 NAAWS 3.1 – North American Architectural Woodwork Standards

1.2 ACTION AND INFORMATION SUBMITTALS

.1 Submit in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product data:

.1 Provide product data.

.2 Manufacturers' printed data sheets.

.3 Shop drawings:

.1 Indicate details of construction, profiles, jointing, fastening and other related details.

.2 Indicate materials, thicknesses, finishes and hardware.

.3 Indicate locations and types of repairs.

.4 Indicate adjacent assemblies and materials.

.5 Indicate materials and details in one-quarter size scale for profiles of components, elevations of units, description of related components and fasteners.

.4 Samples: confirm required with Contract Administrator before submitting.

.1 Submit duplicate samples: sample size 300mm x 300mm or 300mm long, unless specified otherwise.

.2 Submit samples of glass, putty, epoxies, adhesives, replacement wood trims and mouldings, new and replacement hardware, weatherstripping and weather-seals.

1.3 CLOSEOUT SUBMITTALS

.1 Record documentation:

.1 Provide digital photographic documentation before, during and after the wood window repairs.

.2 Format: maintain .jpg format files in standard resolution taken promptly during the course of work and as directed by Contract Administrator (photos to be minimum 12 megapixels).

.3 Frequency: distributed per each stage (before, during and after) within 24 hours of photograph being taken on site.

.4 Additional pictures may be requested at the Contract Administrators' discretion.

.5 Do not use progress or any other Project photographs for promotional purposes without the The City's written consent.

.6 Organize photographs appropriately and include in project close-out requirements.

.7 Provide digital copy of record drawings.

1.4 QUALITY ASSURANCE

.1 Lumber by grade stamp of agency certified by Canadian Lumber Standards Accreditation Board (CLSAB).

.2 All exposed wood which is to have a clear or stained finish shall be edge grain, clear of knots, plugs, patches, defects, and stains.

.3 Contractors undertaking work in this section are required to be skilled and trained craftsmen who have a minimum of five (5) years of experience in this field.

.4 Construct mock-up in accordance with Section 01 45 00 – Quality Control.

.1 Construct a full-size mock-up of one (1) sash and one (1) sill repair including specified materials and cleaned / new hardware.

.2 Allow 48 hours notice for review of mock-up by Contract Administrator before proceeding with work.

.3 Accepted mock-up may be incorporated into final work.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements and with manufacturer's written instructions.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and handling of salvaged and dismantled components:

.1 Protect from weather and dampness.

.2 Store materials off ground, indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.3 Store and protect wood products from nicks, scratches, and blemishes.

.4 Replace defective or damaged materials with new.

.5 Ensure easy accessibility.

.6 Store together in logical groupings.

.7 Pad, support and stack sashes and frames. Prevent damage to components.

.8 Maintain component labels in good condition and securely attached to components until re-installation.

1.6 SITE CONDITIONS

.1 Existing conditions:

.1 Existing paint is assumed to contain lead. Refer to Division 2 for hazardous materials abatement.

Part 2 PRODUCTS

2.1 EXISTING MATERIALS

.1 Salvaged components from other windows:

.1 Salvage existing double hung windows being removed for replacement. Salvage components from these windows for use in restoration of other double hung windows.

.2 Existing components from windows being restored:

.1 Glazing: retain, clean and store existing glazing for reinstallation.

.2 Hardware: retain, restore and store existing hardware for reinstallation.

.3 Sashes: retain, restore and store existing sashes for reinstallation.

.4 Frame: retain, restore and protect existing frames.

2.2 MATERIALS

.1 Adhesive: to CSA O112.10, to grade of service required in accordance with CSA O122, Urea-formaldehyde free.

.2 Softwood lumber: S4S, moisture content 19% or less in accordance with following standards:

- .1 CSA O141.
- .2 NLGA Standard Grading Rules for Canadian Lumber.
- .3 NAAWS custom grade, moisture content as specified.
- .4 AWMAC premium grade, moisture content as specified
- .5 Wood species, grade and grain: to match existing or Accoya Wood as supplied by Accsys Technologies.

.3 Hardwood lumber: moisture content in accordance:

- .1 National Hardwood Lumber Association (NHLA).
- .2 AWMAC premium grade, moisture content as specified.
- .3 Wood species: Accoya Wood as supplied by Accsys Technologies.

.4 Finger-joined and laminated materials not acceptable.

2.3 ACCESSORIES

.1 Nails: galvanized for exterior work, interior humid areas and for treated lumber; plain finish elsewhere. Size and type to suit application.

.2 Wood screws: electroplated steel or brass, type and size to suit application. Stainless steel where indicated.

.3 Splines: wood.

.4 Glass: thickness as indicated in Section 08 80 00 – Glazing.

.5 Adhesive: two-part epoxy, Cold Cure by Industrial Formulators, or approved equal.

.6 Glazing clips: steel points.

.7 Glazing compound:

- .1 Linseed oil putty for wood window single-glazed installations.
- .2 Silicone glazing sealant for wood window double-glazed installations with wood stops.

.8 Glazing tape:

- .1 Preformed butyl compound; coiled on release paper; size to suit application; black colour.

.9 Primer: boiled linseed oil mixed 1:1 with turpentine spirits.

.10 Epoxy filler: two-part epoxy wood restoration system, Abatron Liquid Wood and WoodEpox.

.11 Weatherstripping:

.1 Sprung bronze, V-type, with adhesive strip, for operating double hung sashes, size to suit application.

.2 Compressible neoprene for bottom of bottom sash and for perimeter of interior storm sashes.

.3 Dust pads for intersections.

.12 Paint stripper: Peel Away.

.13 Metal filler: 2-part epoxy with metal reinforcing.

.14 Penetrating oil and light machine oil.

Part 3 EXECUTION

3.1 WINDOW REPAIR – PREPARATION

.1 Carefully pry / remove applied stops and parting strips. Mark and set aside for reinstallation.

.2 Remove interior and exterior storm windows, primary sash and doors. Mark locations for reinstallation.

.3 Document and photograph storm sashes indicated for permanent storage. Store where directed.

.4 Remove hardware and thresholds, mark locations, and set aside for cleaning and reinstallation.

.5 Inspect storms, sashes, frames and sills for evidence of decay, loose joints and severe corrosion. Report findings to Contract Administrator.

3.2 STORM AND SASH REPAIR

.1 Wood windows:

.1 Carefully remove putty (single glazed sash) or wood stops and glazing compounds (double glazed sash).

.2 Carefully remove glass panes. Mark locations for reinstallation. Scrape and clean sash and glass rebates. Remove all loose and excessively thick paint.

.3 Dutchman repairs:

.1 If sash is damaged or decayed, disassemble sash and cut out decayed wood. Cut back to sound wood. Make smooth straight even cut for joining replacement piece.

.2 Mill replacement piece to match existing. Duplicate dimensions and profiles exactly. Make custom cutter to achieve exact match. Use same wood species and grain orientation.

.4 Joints:

.1 Lay out and cut joints.

.2 Scribe and shape repair piece as required.

.3 Fit joints tightly and accurately together.

.4 Trial fit joints before fastening in place. Adjust as necessary to ensure close accurate fit with adjacent surfaces.

.5 Joining:

.1 Apply adhesive evenly to both surfaces.

.2 Join pieces together.

.3 Avoid adhesive drippings. Remove drips and splashes immediately.

.4 Remove any hard cured adhesive evident in completed work.

.5 Set finishing nails to receive filler.

.6 Surface voids:

.1 Fill surface voids with epoxy compounds formulated for wood.

.2 Build up surfaces. Apply patching compound.

.3 Alloy to cure and sand smooth.

.7 Re-glazing:

.1 Seal glazing rebates with primer. For double glazed sash, ensure compatibility with glazing compound.

.2 Locate and secure glazing light using glazers' clips.

.3 For single glazed sash, fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

.4 For double glazed sash, fill gaps between glazing and stops with glazing compound. Reapply removed wood stops and secure in place.

3.3 FRAME AND SILL REPAIR

.1 Wood window frames:

.1 Scrape and clean frames and sills.

.2 Repair decayed wood as in sub-section 3.2.1.

.3 Repair surface voids as in sentence 3.2.1.5.

3.4 HARDWARE RESTORATION

.1 Remove paint from hardware and screws by boiling in vinegar.

.2 Lubricate parts including restored sash pulleys prior to reinstallation.

.3 Clean operators, hinges and locks using a fine wire wheel.

.4 Replace missing or broken hardware and hinges.

.5 Replace existing fasteners with new matching fasteners.

.6 Store restored hardware and screws for reinstallation.

3.5 WINDOW REASSEMBLY

.1 Test fit primary sash to frames. Plane wood components to fit as required.

.2 Reattach sash chains. Set window sash in frames. Apply parting strips and stops. Provide new components to match existing if existing were damaged during removal. Adjust stops to hold sash in place yet allow movement. Reinstall restored hardware.

.3 To maintain security restored windows are to be non-operating / securely fixed in place but appear as if they do operate.

.4 Install weatherstripping:

.1 Coordinate installation of sash with installation of weatherstripping.

.2 Install new weatherstripping in accordance with manufacturer's written instructions.

.3 Install weatherstripping joints between operable sash and fixed sash and frames. Apply spring bronze at jambs and meeting rails. Apply compressible gasket at bottom of bottom sash. Apply dust pads at corners.

.4 Install new weatherstripping without breaks at corners and perimeter.

.5 Seal joints between exterior perimeter of frames and exterior wall with sealant. Seal joints between sashes and frames as indicated.

.6 Reinstall metal exterior storm windows. Adjust hinges and latching mechanisms to fine tune the sash's fit in the frame. Lubricate moving components. Ensure proper operation.

.7 Reinstall interior storm windows. Plane as required for a snug fit. Apply weatherstripping to provide a tight seal.

3.6 FINISH CARPENTRY

.1 Do finish carpentry to Quality Standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC), except where specified otherwise.

.2 Scribe and cut as required, fit to abutting walls and surfaces.

.3 Form joints to conceal shrinkage.

.4 Fastening:

.1 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.

.2 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.

.3 Set finishing nails to receive filler. Where screws are used to secure members, countersink screw in round smooth cut hole and plug with wood plug to match material being secured.

.4 Replace items of finish carpentry with damage to wood surfaces including hammer and other bruises.

.5 Standing and running trim:

.1 Install window trim in single lengths without splicing.

.6 Frames:

.1 Set frames with plumb sides and level heads and sills and secure.

3.7 PAINTING

.1 Perform re-painting and finishing of windows in accordance with Section 09 91 10 - Painting.

.2 Keep moving parts and flexible components free from primer and paint.

.3 Apply primer and first topcoat prior to re-assembly of components. Apply second topcoat after re-assembly.

3.8 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Remove glazing materials from finish surfaces. Remove labels after work is complete.

.3 Clean glass using approved non-abrasive cleaner in accordance with manufacturer's instructions.

.4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.9 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by finish carpentry installation.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A568/A568M – Standard Specification for Steel, Sheet, Carbon, Structural and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for

.2 Manitoba Building Code (MBC)

.3 National Fire Protection Association (NFPA)

.1 NFPA 80 – Standards for Fire Doors and Other Opening Protectives

.4 Underwriters' Laboratories of Canada (ULC)

.1 ULC 104 – Standard Method for Fire Tests of Door Assemblies

.2 ULC 105 – Standard Specification for Fire Door Frames Meeting the Performance Required by ULC 104

.3 ULC List of Equipment and Materials, Volume II, Building Construction

1.2 QUALITY ASSURANCE

.1 Do Work to requirements of the following standards:

.1 ULC List of Equipment and Materials, Volume II, Building Construction

.2 ULC 104

.3 ULC 105

.4 NFPA 80

.2 Doors and frames in fire separations shall meet the temperature rise limit as stated in the MBC table 3.1.8.15.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00, Submittal Procedures.

.2 Submit shop drawings clearly indicating each type of door and frame, material, steel core thickness, mortises, reinforcements, location of exposed fasteners, anchors, openings, arrangement of hardware, and finishes.

1.4 FABRICATION STANDARDS

.1 Fabricate doors and frames to Canadian Manufacturing Specification for steel doors and frames, except where specified otherwise.

1.5 SCHEDULE

.1 Doors and frames listed on door schedule are furnished as an assistance to the fabricator, and should not be considered as entirely inclusive. Examine drawings and specifications, and determine extent and quantity required. Should any door or frame be omitted in the schedule, the fabricator shall supply door or frame as required for similar or same purpose.

Part 2 PRODUCTS

2.1 STEEL

.1 Commercial grade steel to ASTM A568/A568M, Class 1, hot-dip galvanized, with ZF75 (A25) coating designation.

2.2 COMPONENT PARTS

.1 Thickness of component parts as follows, unless otherwise specified.

.2 Door frames: 1.5mm (16 gauge)

.3 Doors:

- .1 Face sheets-honeycomb: 1.2mm (18 gauge)
- .2 Face sheets-reinforced: 1.6mm (0.06”)

.4 Accessories; doors and frames:

- .1 Lock and strike reinforcements: 1.6mm (0.06”)
- .2 Hinge reinforcement bottom and mid points: 2.7mm (12 gauge)
- .3 Hinge reinforcement (high frequency): top-angle 50mm (2") high x 20mm (3/4") leg x 25mm (1") leg x 2.38mm (0.09”) thick
- .4 Flush bolt reinforcements: 1.6mm (0.06”)
- .5 Reinforcements for surface applied hardware: 1.2mm (18 gauge)
- .6 Reinforcing for pulls: minimum 400mm (16") long
- .7 Top and bottom channels: 1.2mm (18 gauge)
- .8 Steel top caps: 0.9mm (20 gauge)
- .9 Glass moldings (non-fire-rated doors): either “Snap-on Type”, or formed steel (screw fixed) 0.9mm (20 gauge)
- .10 Glass moldings (fire-rated doors): formed steel 0.9mm (20 gauge)
- .11 Mortar guard boxes: 0.8mm (22 gauge)
- .12 Jamb floor anchors: 1.6mm (0.06”)
- .13 Wall anchors:
  - .1 Masonry strap type: 1.2mm (18 gauge)
  - .2 Masonry wire type: 4.0mm (5/32") diameter
  - .3 Masonry stirrup-strap type: 1.6mm (0.06”)
  - .4 Stud type: 0.9mm (20 gauge)

.5 Existing masonry/concrete wall type: 0.9mm (20 gauge)

.14 Glazed opening reinforcing: 0.9mm (20 gauge)

.15 Jamb spreaders: 0.9mm (20 gauge)

2.3 DOOR CONSTRUCTION

.1 Doors shall be swing type, flush, with provision for glass and/or louvre openings as indicated on plans and schedules, minimum 45mm (1-3/4") thick, unless noted otherwise.

.2 Doors shall be blanked, reinforced, drilled and tapped for mortised, templated hardware, and reinforced, where required, for surface mounted hardware.

.3 Honeycomb core doors, for interior use, normal frequency: cores of “Honeycomb” core material, laminated under pressure to face sheets. Reinforce for hardware as specified. Top and bottom of door closed with recessed spot welded channel end closures. Longitudinal edges mechanically interlocked and welded at maximum 150mm (6”) on centre, grind flush, fill and sand.

.4 Insulated core, flush type, for exterior use, reinforced construction: provide urethane foam insulated cores to RSI = 1.76 (R = 10), laminated by adhesive to face sheets. Reinforced for hardware as specified. Top and bottom of door closed with recessed spot welded channel end closures. Longitudinal edges mechanically interlocked and welded at maximum 150mm (6”) on centre. Grind flush, fill and sand. Small glazed openings reinforcing welded to both face and sheets. Install vinyl cap in top channel.

.5 All doors with glazed openings larger than 150mm (6”) shall be reinforced with 0.9mm (20 gauge) channel, before stops and trim applied.

.6 Provide vinyl insert in top of all hollow metal doors, interior and exterior.

2.4 LABELED FIRE DOORS AND FRAMES

.1 Provide labeled fire doors and frames for openings requiring fire protection ratings as scheduled, and generally in the following locations: firewalls and fire separations, corridors, stairwells, and to storage and mechanical rooms. Attach ULC labels to doors and frames.

.2 Doors with bottom vertical rods must be sized to provide proper bottom clearance.

2.5 FRAMES

.1 Mitred or mechanically jointed, and continuously welded on the inside of the profile. Welded joints to be ground to a smooth, uniform finish.

.2 Glazed openings: glazing bead, formed channel, minimum 16mm (5/8") high, accurately fitted at corners, “snap-on” type or fastened to frame sections with countersunk oval head sheet metal screws at 450mm (18") maximum, 50mm (2") from each end.

.3 Butt joints of mullions and transoms: accurately cope, securely weld and grind smooth.

.4 Blank, reinforce, drill and tap for mortised butts and strike. Reinforce for surface mounted hardware. Prepare each door for rubber bumpers, three (3) for single door openings, two (2) for double door openings.

.5 Top hinge reinforcement: weld in top hinge reinforcement with 20mm (3/4") leg to hinge reinforcement, 25mm (1") to frame.

.6 Insulation: provide mineral fibre insulation in all exterior frame cavities.

.7 Pressed steel frame sidelights: provide structural steel reinforcement sections, where indicated.

.8 Exterior frames shall be thermally-broken.

2.6 FRAME ANCHORS

.1 Frames for installation in masonry walls shall be provided with adjustable jamb anchors of the "T" strap, "L" strap, "Stirrup and Strap" or "Wire Types". The number of anchors provided on each jamb shall be as follows:

.1 Frames up to 2300mm (7'-8") height – three (3) anchors (six (6) for "L" strap)

.2 Frames 2300mm (7'-8") to 2450mm (8'-2") – four (4) anchors (eight (8) for "L" strap)

.2 Frames for installation in stud partitions shall be provided with steel anchors of suitable design. For installation inside each jamb as follows:

.1 Frames up to 2300mm (7'-8") height – four (4) anchors

.2 Frames 2300mm (7'-8") to 2450mm (8'-2") – five (5) anchors

.3 Frames for installation in existing masonry openings shall be provided with expansion shields and countersunk screws, for installation on each jamb as follows:

.1 Frames up to 2300mm (7'-8") height – four (4) anchors

.2 Frames 2300mm (7'-8") to 2450mm (8'-2") – five (5) anchors

2.7 SHOP PRIMING

.1 Doors and frames: chemically treat for good paint adhesion, all visible surfaces of all doors and frames made from corrosion resistant steel (CRS), with a CRS primer. Factory apply touch-up at those areas where coating has been removed due to grinding or welding, to all doors and frames made from zinc wipe coated galvanized steel.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Install hollow metal frames and glazed screens plumb and square, with maximum diagonal distortion of 1.5mm (1/16”). Ensure frames are securely and rigidly anchored to adjacent construction.

.2 Coordinate the installation of glass and glazing.

.3 During installation, touch-up all scratched or damaged surfaces.

.4 Installer to ensure exterior frames fully insulated before installing. Remedy as required.

3.2 DOOR FRAME INSTALLATION

.1 Set frames plumb, square, level, and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreaders at third points of door opening to maintain frame width. Provide vertical support at center of head for openings over 1200mm (4ft) wide. Remove temporary spreaders after frames are built-in.

.4 Make allowance for deflection to ensure structural loads are not transmitted to frames.

.5 Fill frames built into masonry with mortar, except exterior frames to be filled with insulation.

3.3 DOOR INSTALLATION

.1 Install doors and hardware in accordance with templates and manufacturer’s instructions.

.2 Adjust operable parts for correct function.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

.2 ASTM A924/A924M – Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

1.2 QUALITY ASSURANCE

.1 Single-source responsibility: provide doors, tracks, motors, and accessories from one (1) manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

.2 Manufacturer qualifications: company specializing in manufacturing products specified in this section with minimum five (5) years documented experience.

.3 Installer qualifications: authorized representative of the manufacturer with minimum five (5) years documented experience.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit shop drawings indicating type of door, materials, assembly details, dimensions, thicknesses, finishes, fabrication, arrangement of hardware, operating mechanism, and required clearances.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Store products in manufacturer's unopened labeled packaging until ready for installation.

.2 Protect materials from exposure to moisture until ready for installation.

.3 Store materials in a dry, ventilated weathertight location.

1.5 MAINTENANCE DATA

.1 Provide data for maintenance of doors and hardware including the motorized door operator for incorporation into maintenance manual.

Part 2 PRODUCTS

2.1 CLOSURE SYSTEM

.1 Standard of acceptance: Model G-5000 steel sectional overhead door, as manufactured by Garaga Inc., and distributed by Daytona Door Products, or approved equal.

2.2 MATERIALS

.1 Enameled steel: galvanized steel sheet in accordance with ASTM A653/A653M, G60 coating, 26-gauge, exterior and interior, in manufacturer's standard colour. Galvanized steel sheet has zinc coating with minimum thickness of 180 g/m^2, polyester paint finish, two (2) coats, to ASTM A924/A924M, thickness: 1.0 mil. Surface of steel sheet is woodgrain with horizontal grooves.

.2 Insulation: high-pressure, CFC-free, polyurethane foam injected between walls of each section. Density: 2.5 lb./ft3 (40.4 kg/m3) with thermal resistance factor of RSI 1.6 per 1" (25 mm) of thickness.

.3 Reinforcement plates: steel, with minimum thickness of 14-gauge (1.8mm), inserted within door sections to provide proper fastening for hinges and plates for electric garage door operator with central trolley.

.4 Section ends: block of grade 4 dry pine, inserted at both ends of each insulated garage door section for fastening of lateral hinges.

.5 Assembly joints: galvanized steel sheets of each door section shall be assembled with a mechanically-embedded, triple-contact weatherstripping, known as Interlok™, ensuring thermal break, and integrity and strength of the assembly.

.6 Windows: clear, double thermopanes with a total thickness of 19mm. Seal 3mm panes in stainless steel extrusions using Intercept™ system with 13mm air space. Windows shall be inserted in expanded PVC frame and factory installed by manufacturer.

.7 Tracks shall be 12 gauge (2.6mm) galvanized steel, 76mm (3"). Horizontal track shall be reinforced with 50mm x 50mm (2" x 2") steel angle.

.8 Hardware:

- .1 Hinges: 13 gauge galvanized steel.
- .2 Industrial rollers: 76mm (3") long with 10 ball bearings.

.9 For doors over 3759mm (12'-4") wide or wider, provide 22 gauge galvanized steel horizontal struts and 13 gauge double hinges at each end.

.10 Torsion type springs: torsion spring lifting system by manufacturer.

.11 Tension bridge reinforcements: as required by manufacturer for doors over 5563mm wide.

.12 Operation: jackshaft-type operator.

.1 Standard of acceptance: Liftmaster Model CRBH501L5R, ½ hp. Operator motor shall be a NEMA 4 dust-tight modification.

.2 Jackshaft-type: come equipped with a built-in chain hoist assembly and with a quick release mechanism to allow for manual operation of the door in the event of a power failure.

.3 The electric motors, control mechanisms, relays, and electrical devices of the operator shall be approved according to CSA and UL standards.

.4 Operators shall feature a positive lock mechanical brake, an instantly reversible motor, and a thermal protection device against power surges. The electric control circuit is of 24 volts.

.5 The door shall travel at a speed of 7.9 to 11 in./sec (200 to 280 mm/sec).

.6 A control station with a key switch for Up/Down/Stop shall be surface mounted where directed.

.7 A safety mechanism with photocells shall be added to each operator in order to stop and reverse the movement of the door in the event an object cuts off the light beam.

2.3 FABRICATION

.1 Fabricate the Work true to dimensions and square. Fabricate finished Work free from distortion and defects detrimental to appearance and performance.

.2 Accurately fit joints and intersecting members with adequate fastenings.

Part 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

.1 Do not begin installation until openings have been properly prepared.

.2 Verify wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

.3 Verify electric power is available and of correct characteristics.

.4 Clean surfaces thoroughly prior to installation.

.5 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.2 INSTALLATION

.1 Installation in strict accordance with manufacturer’s instructions, and Work to be done by an authorized installer.

.2 Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.

.3 Anchor assembly to wall construction and building framing without distortion or stress.

.4 Securely brace door tracks suspended from structure. Secure tracks to structural members only.

.5 Fit and align door assembly including hardware.

.6 Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

3.3 CLEANING AND ADJUSTING

.1 Adjust door assembly to smooth operation.

.2 Clean doors, frames and glass.

.3 Remove temporary labels and visible markings.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

.1 Fire resistive framing system.

.2 Vision lights in fire rated doors, borrowed lights, windows and walls with fire rating requirement.

1.2 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM)

- .1 ASTM A501 – Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
- .2 ASTM E119 – Methods for Fire Tests of Building Construction and Materials
- .3 ASTM E152 – Methods of Fire Tests of Door Assemblies
- .4 ASTM E163 – Methods for Fire Tests of Window Assemblies
- .5 ASTM E2010 – Standard Test for Positive Pressure of Fire Tests of Window Assemblies
- .6 ASTM E2074 – Standard Test Method for Fire Tests of Door Assemblies, including Positive Pressure Testing of Side-hinged and Pivoted Swinging Door Assemblies
- .7 ASTM F588 – Test Method for Resistance of Window Assemblies to Forced Entry Excluding Glazing

.2 American National Standards Institute (ANSI)

- .1 ANSI Z97.1 – Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

.3 National Fenestration Rating Council (NFRC)

- .1 NFRC 100 – Procedure for Determining Fenestration Product U-Factors
- .2 NFRC 200 – Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

.4 National Fire Protection Association (NFPA)

- .1 NFPA 80 – Fire Doors and Windows
- .2 NFPA 251 – Fire Tests of Building Construction and Materials
- .3 NFPA 252 – Fire Tests of Door Assemblies
- .4 NFPA 257 – Fire Tests of Window Assemblies

.5 Underwriters Laboratories, Inc. (UL)

.1 UL 9 – Standard for Safety of Fire Tests of Window Assemblies

.2 UL 10B – Standard for Safety of Fire Tests of Door Assemblies

.3 UL 10C – Standard for Safety of Positive Pressure Fire Tests of Door Assemblies

.4 UL 263 – Fire Tests of Building Construction and Materials

.6 Underwriters Laboratories of Canada (ULC)

.1 ULC 101 – Fire Tests of Building Construction and Materials

.2 ULC 104 – Fire Tests of Door Assemblies

.3 ULC 106 – Fire Tests of Window Assemblies

1.3 PERFORMANCE REQUIREMENTS

.1 Fire rating: must meet 20, 45, 60, 90 or 120 minutes as specified.

.2 Fire Resistive Wall Assembly Certifications: must meet 60-120 minute fire resistive wall assemblies tested in accordance with ASTM E119, NFPA 251, UL 263 and ULC 101.

.3 Fire Resistive, Temperature Rise Door Assembly Certifications: must meet 60-90 minute fire resistive temperature rise door assemblies tested in accordance with NFPA 252, UL 10B, UL 10C and ULC 104. Must meet 250 degrees F/450 degrees F temperature rise door requirements.

.4 Fire Protective Door Assembly Certifications: must meet 20-45 minute fire protective door assemblies shall be tested in accordance with NFPA 80, NFPA 252, ASTM E152, ASTM E2074, UL 10B, UL 10C and ULC 104.

.5 Fire Protective Window Assembly Certifications: must meet 20-45 minute fire protective window assemblies shall be tested in accordance with NFPA 80, NFPA 257, ASTM E163, ASTM E2010, UL 9 and ULC 106.

.6 Air Infiltration: must meet <0.01 cfm/ft2

.7 Water Resistance Test Pressure: up to 20.0 psf

.8 Uniform Load Deflection Test Pressure: up to +/- 50.0 psf

.9 Uniform Load Structural Test Pressure: up to +/- 75.0 psf

.10 Forced Entry Resistance: must meet ASTM F588, Type D

.11 Glazing: Fire protective glazing in 20-45 minute fire protective doors and openings up to the maximum size tested. Fire resistive glazing that meets ASTM E119/UL 263/ULC 101 up to the max. size tested.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 – Submittal Procedures.

.2 Shop drawings:

.1 Submit shop drawings showing layout, profiles and product components.

.2 Samples: submit samples for finishes, colours and textures.

.3 Technical information: submit latest edition of manufacturer's product data providing product descriptions, technical data and installation instructions.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver and store materials, undamaged at the site in their original packages with manufacturer's labels and seals intact. Maintain protective coverings until materials are required. Store materials on a level base, off the ground. Take care to prevent scratching at all times from cutting and tools.

.2 Deliver, store and handle units so as to prevent twisting, warping and damage. Do not remove units from crates or protective covering until ready for installation.

1.6 MAINTENANCE DATA

.1 Provide operation and maintenance data for cleaning and maintenance of aluminum finishes for incorporation into the Maintenance Manuals.

1.7 WARRANTY

.1 Provide a written warranty in accordance with General Conditions.

.2 Warrant fire-rated aluminum storefront against leakage, defects, and malfunctions, under normal usage, for a period of five (5) years from date of Ready-for-Takeover.

1.8 PROTECTION

.1 Protect finished surfaces. Do not use coatings that will become hard to remove or leave residue.

Part 2 PRODUCTS

2.1 MANUFACTURER

.1 Manufacturer of framing system: GPX Architectural Series Framing, as manufactured and distributed by SAFTI *FIRST* Fire Rated Glazing Solutions, or approved equal.

.2 Manufacturer of glazing material: SuperLite II-XL 90/120 FR glazing, as manufactured and distributed by SAFTI *FIRST* Fire Rated Glazing Solutions, or approved equal.

.3 Fire rated glass and framing shall be provided by a single source.

2.2 MATERIALS – FRAMING

.1 Fire resistive, temperature rise framing system rated for: 120 minutes.

.2 Properties:

.1 Fire resistive aluminum door capable of accommodating concealed hardware.

.2 Internal framing: Internal tube steel framing shall conform to ASTM A501. Formed steel retainers shall be galvanized conforming to ASTM A527.

.3 Insulation: framing system shall insulate against the effects of fire, smoke and heat transfer from either side. Perimeter of the framing system to the rough opening shall be firmly packed with mineral wool fire stop insulation or appropriately rated intumescent sealant.

.4 Fasteners: type recommended by manufacturer. No exposed fasteners allowed.

.5 Glazing accessories: glazing material perimeter shall be separated from perimeter framing system with approved flame retardant glazing tape. Glazing panel shall be caulked continuously around the edge to the tube steel frame utilizing neutral cure silicone. Silicone setting blocks recommended.

2.3 MATERIALS – GLASS

.1 Assemblies shall be glazed with material as specified in Article 2.1, Manufacturer.

.2 Properties:

.1 Individual lights shall be permanently identified with listing mark.

.2 Glazing material installed in “Hazardous Locations” (subject to human impact) shall be certified to meet the applicable requirements for fire rated assemblies referenced in ANSI Z97.1.

.3 Temperature rise on the unexposed side of glazing material shall be limited to 250 degrees Fahrenheit when required.

.4 Pressure glazing is acceptable.

.3 Logo: each piece of fire rated glazing shall be labeled with a permanent logo.

2.4 FABRICATION

.1 Assemblies shall be furnished assembled (should configurations and job site conditions allow).

.2 Door assemblies shall be factory prepared for field mounting of hardware.

.3 Fabrication dimensions: fabricate to approved dimensions. Contractor shall guarantee dimensions within required tolerance. Obtain approved shop drawings prior to fabrication.

2.5 FINISHES

.1 Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designing finishes.

.2 Covers shall be chemically cleaned and pretreated; black anodized finish.

.3 Protect finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.

.4 Variations in appearance of abutting or adjacent pieces are acceptable. Noticeable variations in the same piece are not acceptable.

2.6 DOOR HARDWARE

.1 Refer to Section 08 71 00 – Finish Hardware.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Prior to commencing Work, inspect surfaces intended to receive Work. Immediately report discrepancies. Do not commence Work until such defects have been corrected.

.2 Commencement of Work is deemed as acceptance of surfaces and conditions.

3.2 INSTALLATION

.1 Fire wall/door installation shall be by a licensed contractor and in strict accordance with the approved shop drawings.

3.3 PROTECTION AND CLEANING

.1 Protect glass from contact with contaminating substances resulting from construction operations. Remove such substances by method approved by manufacturer.

.2 Wash glass on both faces by method recommended by glass manufacturer.

END OF SECTION

Part 1 GENERAL

1.1 REGULATORY

.1 Hardware for doors in fire separations and exit doors shall be certified by a Canadian Certifications Organization accredited by the Standards Council of Canada.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide in accordance with Section 01 33 00 – Submittal Procedures.

.2 Shop drawings:

.1 Submit hardware schedule clearly indicating hardware proposed, including make, model, material, function, finish and other pertinent information.

.2 Doors and frames listed on door schedule are furnished as an assistance to the supplier and shall not be considered as entirely inclusive. Examine drawings and specifications, and determine extent and quantity required. Should any door or frame be omitted in the schedule, the hardware supplier shall supply hardware required for same or similar purpose.

1.3 DELIVERY AND STORAGE

.1 Store finishing hardware in locked, clean and dry area.

.2 Package each item of hardware, including fastenings, separately or in like groups of hardware. Label each package as to item definition and location.

.3 Maintain inventory list with hardware schedule.

1.4 MAINTENANCE DATA

.1 Provide maintenance data, parts list, and manufacturer's instructions for each type of door closer, lockset, door holder and fire exit hardware.

.2 Brief maintenance staff regarding proper care, cleaning and general maintenance.

1.5 MAINTENANCE MATERIALS

.1 Supply two (2) sets of wrenches for door closers, locksets and fire exit hardware.

Part 2 PRODUCTS

2.1 HARDWARE ITEMS

.1 Use one (1) manufacturer's products only for all similar items.

2.2 DOOR HARDWARE

.1 Finishing hardware shall be as described in the hardware schedule.

.2 Butts: provide one and a half (1-1/2) pair for each door leaf up to and including 2134mm (7ft) in height.

2.3 FASTENINGS

.1 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.2 Exposed fastening devices to match finish of hardware.

.3 Where pull is scheduled on one (1) side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.

.4 Use fasteners compatible with material through which they pass.

2.4 KEYING

.1 All locks shall be keyed differently to the existing Master Key system.

.2 Note Hardware Codes are provided to set a standard of quality and function. Confirm final keying requirements with the City. Submit key schedule for The City's review.

.3 Provide keys in duplicate for every lock in this Contract.

.4 Provide three (3) master keys.

Part 3 EXECUTION

3.1 INSTALLATION INSTRUCTIONS

.1 Furnish metal door and frame manufacturers with complete instructions and templates for preparation of their Work to receive hardware.

.2 Follow manufacturer's instructions for proper installation of each hardware component.

.3 Install hardware to standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers Association. Refer to spec. detail 8.3 for recommended mounting heights.

.4 Install closers and stops to allow maximum door swing permitted by the hardware and adjacent construction.

.5 Where door stop contacts door pulls, mount stop to strike bottom of pull.

.6 Any existing doors or frames to be reused shall be prepared to accommodate any new hardware. Patch existing door as required.

3.2 HARDWARE CODES

.1 Refer to hardware groups following this section.

Legend:
↯Electrified Opening

Door#	HwSet#
003	01
005	02
011↯	03
012	04
013	05
016	06
018↯	07
019	08
020	08
021A	09
021B	09
023	10
024↯	11
025A↯	12
025B↯	12
100A↯	13
100B	14
101↯	15
102↯	15
103	16
104	17
107	17
108	17
109	17
110	17
111↯	11
113↯	12
114	18
116A↯	19
116B↯	20
116C↯	21
118↯	22
119	23
120A↯	20
120B↯	21
203↯	22
204A↯	19
204B↯	20
204C↯	21
207↯	22
210	18
211↯	12
212	17
213	17

Door#	HwSet#
214	17
215	17
216	17
217	17
218	17
219	17
220	17
221A↯	20
221B↯	21
BL-01	24
BL-02	24
BL-03	24
BL-04	24
S01A↯	25
S01B	17
S01C	17
S01D	17
S01E	17
S01F	17
S01G	17
S01H	17
S02A↯	26
S02B↯	27
S02C↯	26
S02D↯	26
S02E↯	26
S02F↯	26
S02G↯	26
S02H↯	26
S03A↯	26
S03B	04
S03C↯	25
S03D	28
S03E	28

Legend:
Link to catalog cut sheet
Electrified Opening

Hardware Group No. 01

For use on Door #(s):
003

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4		652	IVE
1	EA	STOREROOM LOCK	ND80RD RHO		626	SCH
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	KICK PLATE	8400 255MM X REQ. WIDTH		630	IVE
1	EA	FLOOR STOP	FS439		630	IVE
1	EA	AIR/SMOKE/SOUND SEAL	188SBK PSA X FRAME PERIMETER		BK	ZER

Hardware Group No. 02

For use on Door #(s):
005

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	HINGE	5BB1 5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80RD RHO		626	SCH
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	AIR/SMOKE/SOUND SEAL	188SBK PSA X FRAME PERIMETER		BK	ZER

Hardware Group No. 03

For use on Door #(s):
011

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1HW 5 X 4.5 NRP		652	IVE
2	EA	MANUAL FLUSH BOLT	FB458		626	IVE
1	EA	DUST PROOF STRIKE	DP1		626	IVE
1	EA	CLASSROOM DEADBOLT	B663R		626	SCH
1	EA	PUSH PLATE	8200 4" X 16" (CFC/CFT TO SUIT)		630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16" (CFC/CFT TO SUIT)		630	IVE
1	EA	OH STOP	100S ADJ (W/ AUTO OPERATOR)		630	GLY
1	EA	SURF. AUTO OPERATOR	4642 LONG 120 VAC	✓	689	LCN
2	EA	FULL LENGTH TOUCH ACTUATOR	8310-836T		630	LCN
2	EA	KICK PLATE	8400 255MM X REQ. WIDTH		630	IVE
2	EA	WALL STOP	WS406/407CVX		630	IVE

OPERATIONAL DESCRIPTION:
-DOOR NORMALLY CLOSED AND LOCKED/UNLOCKED.
-INSIDE & OUTSIDE ACTUATORS CYCLE DOOR OPERATOR.
-ROCKER SWITCH ON AUTO OPERATOR TURNS DEVICE ON/OFF/HOLD OPEN. KEEP TURNED OFF WHILE DOOR IS LOCKED.
-FREE EGRESS AT ALL TIMES.

Hardware Group No. 04

For use on Door #(s):
012 S03B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	HARDWARE	EXISTING TO REMAIN		

Hardware Group No. 05

For use on Door #(s):
013

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80RD RHO		626	SCH
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	KICK PLATE	8400 255MM X REQ. WIDTH		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	AIR/SMOKE/SOUND SEAL	188SBK PSA X FRAME PERIMETER		BK	ZER

Hardware Group No. 06

For use on Door #(s):
016

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	HARDWARE	TO LATER DETAIL			

Hardware Group No. 07

For use on Door #(s):
018

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 5 X 4.5 NRP		652	IVE
2	EA	PUSH PLATE	8200 4" X 16"		630	IVE
2	EA	PULL PLATE	8303 10" 4" X 16"		630	IVE
2	EA	OH STOP	100S ADJ (W/ AUTO OPERATOR)		630	GLY
1	EA	SURF. AUTO OPERATOR	9153 LONG2 MS AS REQ (120 VAC)	✓	ANCLR	LCN
1	EA	SWITCH ROCKER	8310-806R	✓		LCN
2	EA	FULL LENGTH TOUCH ACTUATOR	8310-836T		630	LCN
2	EA	KICK PLATE	8400 255MM X REQ. WIDTH		630	IVE

OPERATIONAL DESCRIPTION:
-DOOR NORMALLY CLOSED/HOLD OPEN AND UNLOCKED.
-INSIDE & OUTSIDE ACTUATORS CYCLE DOOR OPERATOR.
-ROCKER SWITCH ON AUTO OPERATOR TURNS DEVICE ON/OFF/HOLD OPEN.
-FREE ACCESS & EGRESS AT ALL TIMES.

Hardware Group No. 08

For use on Door #(s):
019 020

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4 NRP		652	IVE
1	EA	CONST LATCHING BOLT	FB52		630	IVE
1	EA	STOREROOM LOCK	ND80RD RHO		626	SCH
1	EA	COORDINATOR	COR X FL		628	IVE
2	EA	MOUNTING BRACKET	MB1/MB2 TO SUIT		689	IVE
2	EA	SURFACE CLOSER	4040XP CUSH ST-3068		689	LCN
2	EA	KICK PLATE	8400 255MM X REQ. WIDTH		630	IVE
1	EA	AIR/SMOKE/SOUND SEAL	188SBK PSA X FRAME PERIMETER		BK	ZER
1	EA	ASTRAGAL	42STST X DOOR HEIGHT		STST	ZER

Hardware Group No. 09

For use on Door #(s):
021A 021B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	HINGE	5BB1 5 X 4.5 NRP		652	IVE
1	EA	CLASSROOM LOCK	ND70RD RHO		626	SCH
1	EA	KICK PLATE	8400 255MM X B-NH-A X REQ. WIDTH		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE

NOTE:
-CONFIRM KEYING REQUIREMENTS WITH OWNER PRIOR ORDERING.

Hardware Group No. 10

For use on Door #(s):
023

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80RD RHO		626	SCH
1	EA	SURFACE CLOSER	4040XP CUSH ST-3068		689	LCN
1	EA	KICK PLATE	8400 255MM X REQ. WIDTH		630	IVE

Hardware Group No. 11

For use on Door #(s):
024 111

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5		652	IVE
1	EA	PUSH PLATE	8200 4" X 16"		630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"		630	IVE
1	EA	OH STOP	100S ADJ (W/ AUTO OPERATOR)		630	GLY
1	EA	SURF. AUTO OPERATOR	4642 LONG 120 VAC	✓	689	LCN
2	EA	FULL LENGTH TOUCH ACTUATOR	8310-836T		630	LCN
1	EA	KICK PLATE	8400 255MM X B-NH-A X REQ. WIDTH		630	IVE
1	EA	AIR/SMOKE/SOUND SEAL	188SBK PSA X FRAME PERIMETER		BK	ZER
1	EA	DOOR BOTTOM	355AA X DOOR WIDTH		AA	ZER

OPERATIONAL DESCRIPTION:
-DOOR NORMALLY CLOSED AND UNLOCKED.
-INSIDE & OUTSIDE ACTUATORS CYCLE DOOR OPERATOR.
-ROCKER SWITCH ON AUTO OPERATOR TURNS DEVICE ON/OFF/HOLD OPEN.
-FREE ACCESS & EGRESS AT ALL TIMES.

Hardware Group No. 12

For use on Door #(s):
025A 025B 113 211

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80RD RHO		626	SCH
1	EA	ELECTRIC STRIKE	6211 FS CON 24 VDC	✓	630	VON
1	EA	SURF. AUTO OPERATOR	4631 WMS 120 VAC	✓	689	LCN
2	EA	FULL LENGTH TOUCH ACTUATOR	8310-836T		630	LCN
1	EA	OCCUPIED INDICATOR	CM-AF500	✓		CAM
1	EA	PUSH TO LOCK BUTTON W INDICATOR	CM-AF550R	✓		CAM
1	EA	KICK PLATE	8400 255MM X REQ. WIDTH		630	IVE
1	EA	MOP PLATE	8400 255MM X REQ. WIDTH		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	AIR/SMOKE/SOUND SEAL	188SBK PSA X FRAME PERIMETER		BK	ZER
1	EA	WIRE HARNESS	CON-6W (IN FRAME)	✓		SCH
1	EA	DOOR CONTACT	679-05_TO SUIT	✓	BLK	SCE
1	EA	ADVANCED LOGIC RELAY	CX-33	✓		CAM
1	EA	EMERGENCY PULL STATIONS	BY DIV. 28	✓		

NOTES:
- CONFIRM LOCATION OF ACTUATORS WITH ARCHITECT/GENERAL CONTRACTOR PRIOR INSTALLATION.

OPERATIONAL DESCRIPTION:
- DOOR IS NORMALLY CLOSED AND UNLOCKED.
- DOOR CAN BE MANUALLY OR AUTOMATICALLY OPENED VIA THE EXTERIOR ACTUATOR.
- PRESSING "PUSH TO LOCK" BUTTON DISABLES EXTERIOR ACTUATOR AND ENGAGES THE FAIL SAFE ELECTRIC STRIKE, PREVENTING ACCESS WHILE OCCUPIED. SIMULTANEOUSLY, THE "LOCKED" INDICATOR NEXT TO "PUSH TO LOCK" BUTTON AND EXTERIOR ""OCCUPIED"" INDICATOR WILL TURN ON.
- FREE EGRESS AT ALL TIMES BY INSIDE ACTUATOR OR BY TURNING INSIDE LEVER. THE "LOCKED"" AND ""OCCUPIED"" INDICATORS WILL TURN OFF UPON EXITING.
- EMERGENCY ACCESS INTO WASHROOM BY USING OVERRIDE KEY IN OUTSIDE LEVER.

Hardware Group No. 13

For use on Door #(s):
100A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	BALANCE HARDWARE	EXISTING TO REMAIN			
1	EA	FOB/CARD READER	BY DIV. 28	✓		

Hardware Group No. 14

For use on Door #(s):
100B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	BALANCE HARDWARE	EXISTING TO REMAIN		

Hardware Group No. 15

For use on Door #(s):
101 102

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80RD RHO	626	SCH
1	EA	ELECTRIC STRIKE	6211 FS CON 24 VDC	630	VON
1	EA	OH STOP	100S ADJ (W/ AUTO OPERATOR)	630	GLY
1	EA	SURF. AUTO OPERATOR	4642 LONG 120 VAC	689	LCN
2	EA	FULL LENGTH TOUCH ACTUATOR	8310-836T	630	LCN
1	EA	OCCUPIED INDICATOR	CM-AF500		CAM
1	EA	PUSH TO LOCK BUTTON W INDICATOR	CM-AF550R		CAM
1	EA	KICK PLATE	8400 255MM X REQ. WIDTH	630	IVE
1	EA	MOP PLATE	8400 255MM X REQ. WIDTH	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	AIR/SMOKE/SOUND SEAL	188SBK PSA X FRAME PERIMETER	BK	ZER
1	EA	WIRE HARNESS	CON-6W (IN FRAME)		SCH
1	EA	DOOR CONTACT	679-05_TO SUIT	BLK	SCE
1	EA	ADVANCED LOGIC RELAY	CX-33		CAM
1	EA	EMERGENCY PULL STATIONS	BY DIV. 28		

NOTES:
- CONFIRM LOCATION OF ACTUATORS WITH ARCHITECT/GENERAL CONTRACTOR PRIOR INSTALLATION.

OPERATIONAL DESCRIPTION:
- DOOR IS NORMALLY CLOSED AND UNLOCKED.
- DOOR CAN BE MANUALLY OR AUTOMATICALLY OPENED VIA THE EXTERIOR ACTUATOR.
- PRESSING "PUSH TO LOCK" BUTTON DISABLES EXTERIOR ACTUATOR AND ENGAGES THE FAIL SAFE ELECTRIC STRIKE, PREVENTING ACCESS WHILE OCCUPIED. SIMULTANEOUSLY, THE "LOCKED" INDICATOR NEXT TO "PUSH TO LOCK" BUTTON AND EXTERIOR ""OCCUPIED"" INDICATOR WILL TURN ON.
- FREE EGRESS AT ALL TIMES BY INSIDE ACTUATOR OR BY TURNING INSIDE LEVER. THE "LOCKED"" AND ""OCCUPIED"" INDICATORS WILL TURN OFF UPON EXITING.
- EMERGENCY ACCESS INTO WASHROOM BY USING OVERRIDE KEY IN OUTSIDE LEVER.

Hardware Group No. 16

For use on Door #(s):
103

Provide each UEP door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	HARDWARE	BY GLASS DOOR SYSTEM MANUFACTURER		

NOTES: AUTOMATIC DOOR OPERATOR BY GLASS DOOR SYSTEM SUPPLIER.

Hardware Group No. 17

For use on Door #(s):

104	107	108	109	110	212
213	214	215	216	217	218
219	220	S01B	S01C	S01D	S01E
S01F	S01G	S01H			

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	HARDWARE	BY GLASS DOOR SYSTEM MANUFACTURER		

Hardware Group No. 18

For use on Door #(s):
114 210

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4		652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S RHO OS-OCC		626	SCH
1	EA	SURFACE CLOSER	4040XP CUSH ST-3068		689	LCN
1	EA	KICK PLATE	8400 255MM X REQ. WIDTH		630	IVE
1	EA	MOP PLATE	8400 255MM X REQ. WIDTH		630	IVE

Hardware Group No. 19

For use on Door #(s):
116A 204A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
2	EA	HINGE	5BB1HW SH 5 X 4.5 NRP			652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 5 X 4.5 CON TW8			652	IVE
1	EA	ELEC FIRE EXIT HARDWARE	LX-RX-QEL-98-L-NL-F-06-CON 24 VDC			626	VON
1	EA	RIM CYLINDER	20-057 ICX			626	SCH
1	EA	OH STOP	100S ADJ (W/ AUTO OPERATOR)			630	GLY
1	EA	SURF. AUTO OPERATOR	4642 LONG 120 VAC			689	LCN
2	EA	FULL LENGTH TOUCH ACTUATOR	8310-836T			630	LCN
1	EA	KICK PLATE	8400 255MM X B-NH-A X REQ. WIDTH			630	IVE
1	EA	AIR/SMOKE/SOUND SEAL	188SBK PSA X FRAME PERIMETER			BK	ZER
1	EA	DOOR BOTTOM	355AA X DOOR WIDTH			AA	ZER
1	EA	WIRE HARNESS	CON___TO SUIT (IN DOOR)				SCH
1	EA	WIRE HARNESS	CON-6W (IN FRAME)				SCH
1	EA	FOB/CARD READER	BY DIV. 28				
1	EA	DOOR POSITION SWITCH	BY DIV. 28				
1	EA	POWER SUPPLY	BY DIV. 28				
1	EA	ADVANCED LOGIC RELAY	CX-33				CAM

NOTE:
-AUTO OPERATOR AND ELECTRIC LATCH RETRACTION DEVICE TO BE CONNECTED TO FIRE ALARM SYSTEM.
-CONFIRM KEYING REQUIREMENTS WITH OWNER PRIOR ORDERING.

OPERATIONAL DESCRIPTION:
-DOOR IS NORMALLY CLOSED AND LOCKED.
-PRESENTING VALID CREDENTIAL, OR SCHEDULED UNLOCK (VIA ACCESS CONTROL SYSTEM), ALLOWS MANUAL ACCESS OR USE OF OUTSIDE ACTUATOR(S).
-INSIDE ACTUATOR(S) ALWAYS FUNCTIONAL. PRESSING IT MOMENTARILY UNLOCKS AND CYCLES DOOR OPERATOR.
-ROCKER SWITCH ON AUTO OPERATOR TURNS DEVICE ON/OFF/HOLD OPEN.
-OUTSIDE KEY OVERRIDE AS REQUIRED.
-FREE EGRESS AT ALL TIMES.

Hardware Group No. 20

For use on Door #(s):

116B 120A 204B 221A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5		652	IVE
1	EA	PUSH PLATE	8200 4" X 16"		630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"		630	IVE
1	EA	SURF. AUTO OPERATOR	4642 LONG 120 VAC	✓	689	LCN
2	EA	FULL LENGTH TOUCH ACTUATOR	8310-836T		630	LCN
1	EA	KICK PLATE	8400 255MM X B-NH-A X REQ. WIDTH		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	AIR/SMOKE/SOUND SEAL	188SBK PSA X FRAME PERIMETER		BK	ZER
1	EA	DOOR BOTTOM	355AA X DOOR WIDTH		AA	ZER

OPERATIONAL DESCRIPTION:
-DOOR NORMALLY CLOSED AND UNLOCKED.
-INSIDE & OUTSIDE ACTUATORS CYCLE DOOR OPERATOR.
-ROCKER SWITCH ON AUTO OPERATOR TURNS DEVICE ON/OFF/HOLD OPEN.
-FREE ACCESS & EGRESS AT ALL TIMES.

Hardware Group No. 21

For use on Door #(s):
116C 120B 204C 221B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
2	EA	HINGE	5BB1HW SH 5 X 4.5 NRP			652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 5 X 4.5 CON TW8			652	IVE
1	EA	ELEC FIRE EXIT HARDWARE	LX-RX-QEL-98-L-NL-F-06-CON 24 VDC			626	VON
1	EA	RIM CYLINDER	20-057 ICX			626	SCH
1	EA	SURF. AUTO OPERATOR	4642 LONG 120 VAC			689	LCN
2	EA	FULL LENGTH TOUCH ACTUATOR	8310-836T			630	LCN
1	EA	KICK PLATE	8400 255MM X B-NH-A X REQ. WIDTH			630	IVE
1	EA	WALL STOP	WS406/407CVX			630	IVE
1	EA	AIR/SMOKE/SOUND SEAL	188SBK PSA X FRAME PERIMETER			BK	ZER
1	EA	DOOR BOTTOM	355AA X DOOR WIDTH			AA	ZER
1	EA	WIRE HARNESS	CON___TO SUIT (IN DOOR)				SCH
1	EA	WIRE HARNESS	CON-6W (IN FRAME)				SCH
1	EA	FOB/CARD READER	BY DIV. 28				
1	EA	DOOR POSITION SWITCH	BY DIV. 28				
1	EA	POWER SUPPLY	BY DIV. 28				
1	EA	ADVANCED LOGIC RELAY	CX-33				CAM

NOTE:
-AUTO OPERATOR AND ELECTRIC LATCH RETRACTION DEVICE TO BE CONNECTED TO FIRE ALARM SYSTEM.
-CONFIRM KEYING REQUIREMENTS WITH OWNER PRIOR ORDERING.

OPERATIONAL DESCRIPTION:
-DOOR IS NORMALLY CLOSED AND LOCKED.
-PRESENTING VALID CREDENTIAL, OR SCHEDULED UNLOCK (VIA ACCESS CONTROL SYSTEM), ALLOWS MANUAL ACCESS OR USE OF OUTSIDE ACTUATOR(S).
-INSIDE ACTUATOR(S) ALWAYS FUNCTIONAL. PRESSING IT MOMENTARILY UNLOCKS AND CYCLES DOOR OPERATOR.
-ROCKER SWITCH ON AUTO OPERATOR TURNS DEVICE ON/OFF/HOLD OPEN.
-OUTSIDE KEY OVERRIDE AS REQUIRED.
-FREE EGRESS AT ALL TIMES.

Hardware Group No. 22

For use on Door #(s):
118 203 207

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5		652	IVE
1	EA	CLASSROOM DEADBOLT	B663R		626	SCH
1	EA	PUSH PLATE	8200 4" X 16" (CFC/CFT TO SUIT)		630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16" (CFC/CFT TO SUIT)		630	IVE
1	EA	OH STOP	100S ADJ (W/ AUTO OPERATOR)		630	GLY
1	EA	SURF. AUTO OPERATOR	4642 LONG 120 VAC	✓	689	LCN
2	EA	FULL LENGTH TOUCH ACTUATOR	8310-836T		630	LCN
1	EA	KICK PLATE	8400 255MM X B-NH-A X REQ. WIDTH		630	IVE
1	EA	AIR/SMOKE/SOUND SEAL	188SBK PSA X FRAME PERIMETER		BK	ZER
1	EA	DOOR BOTTOM	355AA X DOOR WIDTH		AA	ZER

OPERATIONAL DESCRIPTION:
-DOOR NORMALLY CLOSED AND LOCKED/UNLOCKED.
-INSIDE & OUTSIDE ACTUATORS CYCLE DOOR OPERATOR.
-ROCKER SWITCH ON AUTO OPERATOR TURNS DEVICE ON/OFF/HOLD OPEN. KEEP OFF WHILE LOCKED.
-FREE ACCESS & EGRESS AT ALL TIMES.

Hardware Group No. 23

For use on Door #(s):
119

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80RD RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP HCUSH ST-3068	689	LCN
1	EA	KICK PLATE	8400 255MM X REQ. WIDTH	630	IVE
1	EA	AIR/SMOKE/SOUND SEAL	188SBK PSA X FRAME PERIMETER	BK	ZER

Hardware Group No. 24

For use on Door #(s):
BL-01 BL-02 BL-03 BL-04

Provide each BL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	HARDWARE	BY FIRE RATED GLASS DOOR SYSTEM MANUFACTURER		

Hardware Group No. 25

For use on Door #(s):
S01A S03C

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
2	EA	HINGE	5BB1HW SH 5 X 4.5 NRP			652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 5 X 4.5 CON TW8			652	IVE
1	EA	ELEC FIRE EXIT HARDWARE	LX-RX-98-L-F-M996-06-FSE-CON			626	VON
1	EA	RIM CYLINDER	20-057 ICX			626	SCH
1	EA	SURFACE CLOSER	4040XP REG			689	LCN
1	EA	KICK PLATE	8400 255MM X B-NH-A X REQ. WIDTH			630	IVE
1	EA	WALL STOP	WS406/407CVX			630	IVE
1	EA	AIR/SMOKE/SOUND SEAL	188SBK PSA X FRAME PERIMETER			BK	ZER
1	EA	DOOR BOTTOM	355AA X DOOR WIDTH			AA	ZER
1	EA	WIRE HARNESS	CON___TO SUIT (IN DOOR)				SCH
1	EA	WIRE HARNESS	CON-6W (IN FRAME)				SCH
1	EA	FOB/CARD READER	BY DIV. 28				
1	EA	DOOR POSITION SWITCH	BY DIV. 28				
1	EA	POWER SUPPLY	BY DIV. 28				

NOTE:
-CONFIRM KEYING REQUIREMENTS WITH OWNER PRIOR ORDERING.

OPERATIONAL DESCRIPTION:
-DOOR IS NORMALLY CLOSED AND LOCKED.
-PRESENTING VALID CREDENTIAL, OR SCHEDULED UNLOCK (VIA ACCESS CONTROL SYSTEM), ALLOWS MANUAL ACCESS.
-OUTSIDE KEY OVERRIDE AS REQUIRED.
-FREE EGRESS AT ALL TIMES.

Hardware Group No. 26

For use on Door #(s):

S02A	S02C	S02D	S02E	S02F	S02G
S02H	S03A				

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	HINGE	5BB1HW SH 5 X 4.5 NRP		652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 5 X 4.5 CON TW8		652	IVE
1	EA	ELEC FIRE EXIT HARDWARE	LX-RX-98-L-F-M996-06-FSE-CON		626	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
1	EA	SURFACE CLOSER	4040XP CUSH ST-3068		689	LCN
1	EA	KICK PLATE	8400 255MM X B-NH-A X REQ. WIDTH		630	IVE
1	EA	AIR/SMOKE/SOUND SEAL	188SBK PSA X FRAME PERIMETER		BK	ZER
1	EA	DOOR BOTTOM	355AA X DOOR WIDTH		AA	ZER
1	EA	WIRE HARNESS	CON___TO SUIT (IN DOOR)			SCH
1	EA	WIRE HARNESS	CON-6W (IN FRAME)			SCH
1	EA	FOB/CARD READER	BY DIV. 28			
1	EA	DOOR POSITION SWITCH	BY DIV. 28			
1	EA	POWER SUPPLY	BY DIV. 28			

NOTE:
-CONFIRM KEYING REQUIREMENTS WITH OWNER PRIOR ORDERING.

OPERATIONAL DESCRIPTION:
-DOOR IS NORMALLY CLOSED AND LOCKED.
-PRESENTING VALID CREDENTIAL, OR SCHEDULED UNLOCK (VIA ACCESS CONTROL SYSTEM), ALLOWS MANUAL ACCESS.
-OUTSIDE KEY OVERRIDE AS REQUIRED.
-FREE EGRESS AT ALL TIMES.

Hardware Group No. 27

For use on Door #(s):
S02B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
2	EA	HINGE	5BB1HW SH 5 X 4.5 NRP			652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 5 X 4.5 CON TW8		✓	652	IVE
1	EA	ELEC PANIC HARDWARE	LX-RX-98-L-M996-06-FSE-CON		✓	626	VON
1	EA	RIM CYLINDER	20-057 ICX			626	SCH
1	EA	SURFACE CLOSER	4040XP CUSH ST-3068			689	LCN
1	EA	KICK PLATE	8400 255MM X REQ. WIDTH			630	IVE
1	SET	GASKETING	429AA X FRAME PERIMETER			AA	ZER
1	EA	DOOR SWEEP	39A X DOOR WIDTH			A	ZER
1	EA	THRESHOLD	625A X FRAME WIDTH			A	ZER
1	EA	WIRE HARNESS	CON___TO SUIT (IN DOOR)		✓		SCH
1	EA	WIRE HARNESS	CON-6W (IN FRAME)		✓		SCH
1	EA	FOB/CARD READER	BY DIV. 28		✓		
1	EA	DOOR POSITION SWITCH	BY DIV. 28		✓		
1	EA	POWER SUPPLY	BY DIV. 28		✓		

NOTE:
- INSTALL DOOR CLOSER SHOE ON #429 AT THE HEAD, LOWER CLOSER INSTALLATION BY 6MM.
- INSTALL EXIT DEVICE STRIKE ON THE #429 AT THE JAMB, SHIFT EXIT DEVICE BACKSET BY 6MM.

OPERATIONAL DESCRIPTION:
-DOOR IS NORMALLY CLOSED AND LOCKED.
-PRESENTING VALID CREDENTIAL, OR SCHEDULED UNLOCK (VIA ACCESS CONTROL SYSTEM), ALLOWS MANUAL ACCESS.
-OUTSIDE KEY OVERRIDE AS REQUIRED.
-FREE EGRESS AT ALL TIMES.

Hardware Group No. 28

For use on Door #(s):
S03D S03E

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4		652	IVE
1	EA	FIRE EXIT HARDWARE	98-L-BE-F-06		626	VON
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	KICK PLATE	8400 255MM X REQ. WIDTH		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
1	EA	AIR/SMOKE/SOUND SEAL	188SBK PSA X FRAME PERIMETER		BK	ZER
1	EA	DOOR BOTTOM	355AA X DOOR WIDTH		AA	ZER

#2624 CITY ARCHIVES BUILDING REDEVELOPEMENT – DOOR & FRAME SCHEDULE

ABBREVIATIONS:

ALUM	Aluminum
CR	Card Reader
CLR	Clear glass
DA	Door Actuator
EHO	Electric Hold Open
EXIST	Existing
FRG	Fire-Resistive Glazing
GWD	Glass warning decals
HM	Hollow Metal
HSDG	Hermetically Sealed Double Glazing
LAM	Laminated glass
NAT	Natural finish
PDO	Power Door Operator
PNT	Paint finish
RML	Removable Mullion
RSG	Rated Safety Glass
TMP-1	Tempered glass, 6mm
TMP-2	Tempered glass, 10mm
TRG	Temperature Rise Glass
ULC	Underwriters Laboratories Canada
WD	Wood
WSC	Wood, Solid Core

GENERAL NOTES:

- Any discrepancies between the drawings & specifications and the door & frame schedule are to be noted to the consultant immediately.
- Site confirm all door & frame sizes with rough opening sizes noted on drawings.
- All exterior HM doors and frames are to be fully insulated c/w HSDG.
- Refer to specifications Section 08 11 13 for hollow metal doors & frames.
- Refer to specifications Section 08 71 00 for door hardware.
- Refer to specifications Section 08 80 00 for glass types & glazing systems.
- Refer to applicable specification details 8.1, 8.2 & 8.3.
- Refer to details DS-1 thru DS-4 following this schedule for door & frame types.
- All doors are to be 44mm (1 ¾") thick, unless noted otherwise.
- All wood doors & frames are to be NAT finish, unless noted otherwise.
- All HM doors & frames are to be PNT finish.
- All glass in doors & frames to be TMP-1, unless noted otherwise.
- All ULC rated doors, frames (including sidelights) and borrowed lights are to have RSG glazing, unless noted otherwise.
- HM doors & frames are to be equipped with all appropriate reinforcing for the hardware specified.
- Reinforcing for door pulls shall be a minimum of 450mm long, unless otherwise required by manufacturer.
- Doors, frames & hardware identified with a fire-resistance rating shall have ULC labels.

#2624 CITY ARCHIVES BUILDING REDEVELOPEMENT – DOOR & FRAME SCHEDULE													
NUMBER	SIZE	DOOR			FRAME				REMARKS	HARDWARE			
		TYPE	MAT'L	GLASS	TYPE	MAT'L	HEAD	GLASS		POWER	CR	ULC	HDWR
003	2'-8"x7'-0"	A	HM	---	1	HM	2"	---	NEW DOOR+FRAME, EXIST R.O.			45 MIN	01
005	3'-0"x5'-0"	A	HM	---	3	HM	2"	---	4-SIDED FRAME			45 MIN	02
011	4'-0"x7'-0" 1'-8"x7'-0"	C	HM	TMP-1	2	HM	2"	---	ACTIVE+INACTIVE LEAF, PDO, EHO	●			03
012	3'-0"x7'-0"	EXIST DOOR+FRAME							EXIST ELEV MECH ROOM			45 MIN	04
013	3'-0"x7'-0"	A	HM	---	1	HM	2"	---	NEW DOOR+FRAME, EXIST R.O.			45 MIN	05
016	2@3'-2"x7'-0"	D	HM	TRG	2	HM	2"	---	MATERIALS LIFT, INTERIOR			90 MIN	06
018	2@3'-2"x7'-0"	B	HM	TMP-1	2	HM	2"	---	PDO, EHO	●			07
019	2@3'-2"x7'-0"	A	HM	---	2	HM	2"	---				45 MIN	08
020	2@3'-2"x7'-0"	A	HM	---	2	HM	2"	---				45 MIN	08
021A	4'-0"x7'-0"	C	HM	TMP-1	1	HM	2"	---					09
021B	4'-0"x7'-0"	C	HM	TMP-1	1	HM	2"	---					09
023	3'-2"x7'-0"	A	HM	---	1	HM	2"	---					10
024	3'-2"x7'-0"	B	HM	TMP-1	1	HM	2"	---	NEW DOOR+FRAME, EXIST R.O., PDO	●			11
025A	3'-2"x7'-0"	A	HM	---	1	HM	2"	---	PDO	●			12
025B	3'-2"x7'-0"	A	HM	---	1	HM	2"	---	PDO	●			12

#2624 CITY ARCHIVES BUILDING REDEVELOPEMENT – DOOR & FRAME SCHEDULE													
NUMBER	SIZE	DOOR			FRAME				REMARKS	HARDWARE			
		TYPE	MAT'L	GLASS	TYPE	MAT'L	HEAD	GLASS		POWER	CR	ULC	HDWR
100A	3'-4"x7'-0"	EXIST WD DOOR			EXIST WD FRAME+TRANSOM				EXIST PDO	●			13
100B	3'-4"x7'-0"	EXIST WD DOOR			EXIST WD FRAME+TRANSOM				EXIST PDO, NEW CR	●	●		14
101	2'-10"x7'-0"	EXIST WD DOOR			EXIST WD FRAME+TRANSOM				PDO	●			15
102	2'-10"x7'-0"	EXIST WD DOOR			EXIST WD FRAME				PDO	●			15
103	3'-4"x7'-0"	E2	ALUM	TMP-1	P7	ALUM	2.6"	TMP-2	GLAZED PARTITION SYSTEM, GWD, PDO	●			16
104	3'-4"x7'-0"	E2	ALUM	TMP-1	SAME FRAME AS 103				GLAZED PARTITION SYSTEM, GWD				17
107	3'-2"x7'-0"	E1	ALUM	TMP-1	P1	ALUM	2.6"	TMP-2	GLAZED PARTITION SYSTEM, GWD				17
108	3'-2"x7'-0"	E1	ALUM	TMP-1	P1	ALUM	2.6"	TMP-2	GLAZED PARTITION SYSTEM, GWD				17
109	3'-2"x7'-0"	E1	ALUM	TMP-1	P1	ALUM	2.6"	TMP-2	GLAZED PARTITION SYSTEM, GWD				17
110	3'-2"x7'-0"	E1	ALUM	TMP-1	P4	ALUM	2.6"	TMP-2	GLAZED PARTITION SYSTEM, GWD				17
111	3'-4"x7'-0"	G	WD	TMP-1	4	WD	1.75"	TMP-1	NEW WOOD PANEL DOOR+FRAME, ENLARGED R.O., PDO	●			18
113	3'-2"x7'-0"	A	HM	---	1	HM	2"	---	PDO	●			12
114	3'-2"x7'-0"	A	HM	---	1	HM	2"	---					18
116A	3'-2"x7'-0"	F1	ALUM	TRG	FR4	ALUM	2.5"	TRG	FRG DOOR+FRAME, GWD, CR, PDO, EHO	●	●	90 MIN	19
116B	3'-2"x7'-0"	B	HM	TMP-1	1	HM	2"	---	INSUL DOOR+FRAME, PDO, EHO	●			20
116C	3'-2"x7'-0"	D	HM	TRG	1	HM	2"	---	CR, PDO, EHO	●	●	90 MIN	21

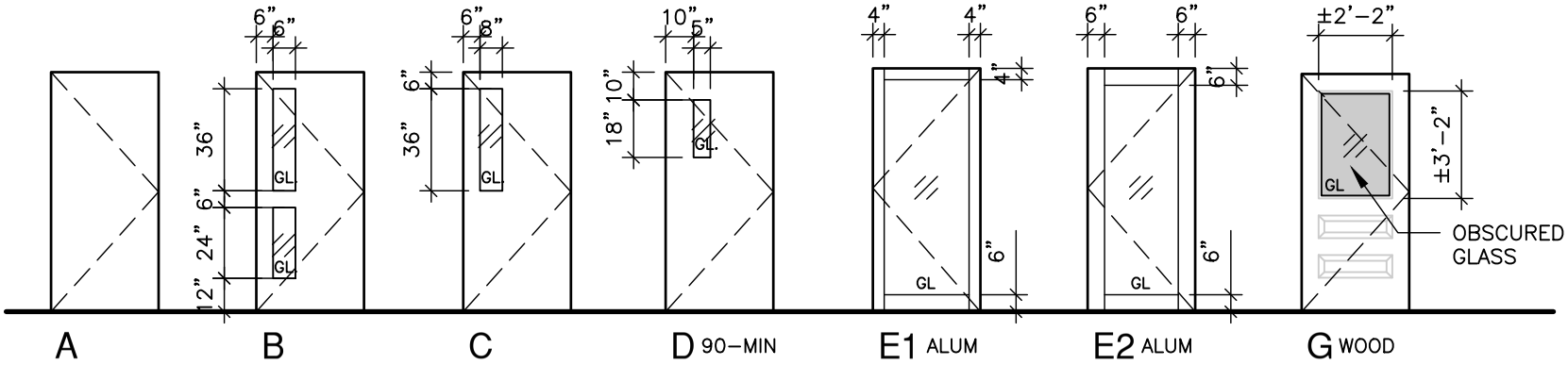
#2624 CITY ARCHIVES BUILDING REDEVELOPEMENT – DOOR & FRAME SCHEDULE													
NUMBER	SIZE	DOOR			FRAME				REMARKS	HARDWARE			
		TYPE	MAT'L	GLASS	TYPE	MAT'L	HEAD	GLASS		POWER	CR	ULC	HDWR
118	3'-4"x7'-0"	C	HM	TMP-1	1	HM	2"	---	PDO	●			22
119	3'-2"x7'-0"	A	HM	---	1	HM	2"	---	MATERIALS LIFT MECH			45 MIN	23
120A	3'-2"x7'-0"	B	HM	TMP-1	1	HM	2"	---	INSUL DOOR+FRAME, PDO, EHO	●			20
120B	3'-2"x7'-0"	D	HM	TRG	1	HM	2"	---	CR, PDO	●	●	90 MIN	21
203	3'-4"x7'-0"	G	WD	TMP-1	4	WD	1.75"	TMP-1	NEW WOOD PANEL DOOR+FRAME, ENLARGED EXIST R.O., PDO	●			22
204A	3'-2"x7'-0"	F1	ALUM	TRG	FR4	ALUM	2.5"	TRG	FRG DOOR+FRAME, GWD, CR, PDO, EHO	●	●	90 MIN	19
204B	3'-2"x7'-0"	B	HM	TMP-1	1	HM	2"	---	INSUL DOOR+FRAME, PDO, EHO	●			20
204C	3'-2"x7'-0"	D	HM	TRG	1	HM	2"	---	CR, PDO	●	●	90 MIN	21
207	3'-4"x7'-0"	G	WD	TMP-1	4	WD	1.75"	TMP-1	NEW WOOD PANEL DOOR+FRAME, ENLARGED EXIST R.O., PDO	●			22
210	3'-2"x7'-0"	A	HM	---	1	HM	2"	---					18
211	3'-2"x7'-0"	A	HM	---	1	HM	2"	---	PDO	●			12
212	3'-2"x7'-0"	E1	ALUM	TMP-1	P5	ALUM	2.6"	TMP-2	GLAZED PARTITION SYSTEM, GWD				17
213	3'-2"x7'-0"	E1	ALUM	TMP-1	P4	ALUM	2.6"	TMP-2	GLAZED PARTITION SYSTEM, GWD				17
214	3'-2"x7'-0"	E1	ALUM	TMP-1	P1	ALUM	2.6"	TMP-2	GLAZED PARTITION SYSTEM, GWD				17
215	3'-2"x7'-0"	E1	ALUM	TMP-1	P2	ALUM	2.6"	TMP-2	GLAZED PARTITION SYSTEM, GWD				17

#2624 CITY ARCHIVES BUILDING REDEVELOPEMENT – DOOR & FRAME SCHEDULE													
NUMBER	SIZE	DOOR			FRAME				REMARKS	HARDWARE			
		TYPE	MAT'L	GLASS	TYPE	MAT'L	HEAD	GLASS		POWER	CR	ULC	HDWR
216	3'-2"x7'-0"	E1	ALUM	TMP-1	P6	ALUM	2.6"	TMP-2	GLAZED PARTITION SYSTEM, GWD				17
217	3'-2"x7'-0"	E1	ALUM	TMP-1	P3	ALUM	2.6"	TMP-2	GLAZED PARTITION SYSTEM, GWD				17
218	3'-2"x7'-0"	E1	ALUM	TMP-1	P1	ALUM	2.6"	TMP-2	GLAZED PARTITION SYSTEM, GWD				17
219	3'-2"x7'-0"	E1	ALUM	TMP-1	P1	ALUM	2.6"	TMP-2	GLAZED PARTITION SYSTEM, GWD				17
220	3'-2"x7'-0"	E1	ALUM	TMP-1	P4	ALUM	2.6"	TMP-2	GLAZED PARTITION SYSTEM, GWD				17
221A	3'-2"x7'-0"	B	HM	TMP-1	1	HM	2"	---	INSUL DOOR+FRAME, PDO, EHO	●			20
221B	3'-2"x7'-0"	D	HM	TRG	1	HM	2"	---	CR, PDO	●	●	90 MIN	21
222	3'-0"x2'-6"	A	HM	---	3	HM	2"	---	4-SIDED FRAME				
S01A	3'-4"x7'-0"	D	HM	TRG	1	HM	2"	---	CR	●	●	90 MIN	25
S01B	3'-4"x7'-0"	F1	ALUM	TRG	FR1	ALUM	2.5"	TRG	FRG DOOR+FRAME, GWD, CR, PDO	●	●	90 MIN	17
S01C	3'-4"x7'-0"	F1	ALUM	TRG	FR1	ALUM	2.5"	TRG	FRG DOOR+FRAME, GWD, EXIT ONLY			90 MIN	17
S01D	3'-4"x7'-0"	F1	ALUM	TRG	FR3	ALUM	2.5"	TRG	FRG DOOR+FRAME, GWD, CR, PDO	●	●	90 MIN	17
S01E	3'-4"x7'-0"	F1	ALUM	TRG	FR3	ALUM	2.5"	TRG	FRG DOOR+FRAME, GWD, EXIT ONLY			90 MIN	17
S01F	3'-4"x7'-0"	F1	ALUM	TRG	FR3	ALUM	2.5"	TRG	FRG DOOR+FRAME, GWD, EXIT ONLY			90 MIN	17

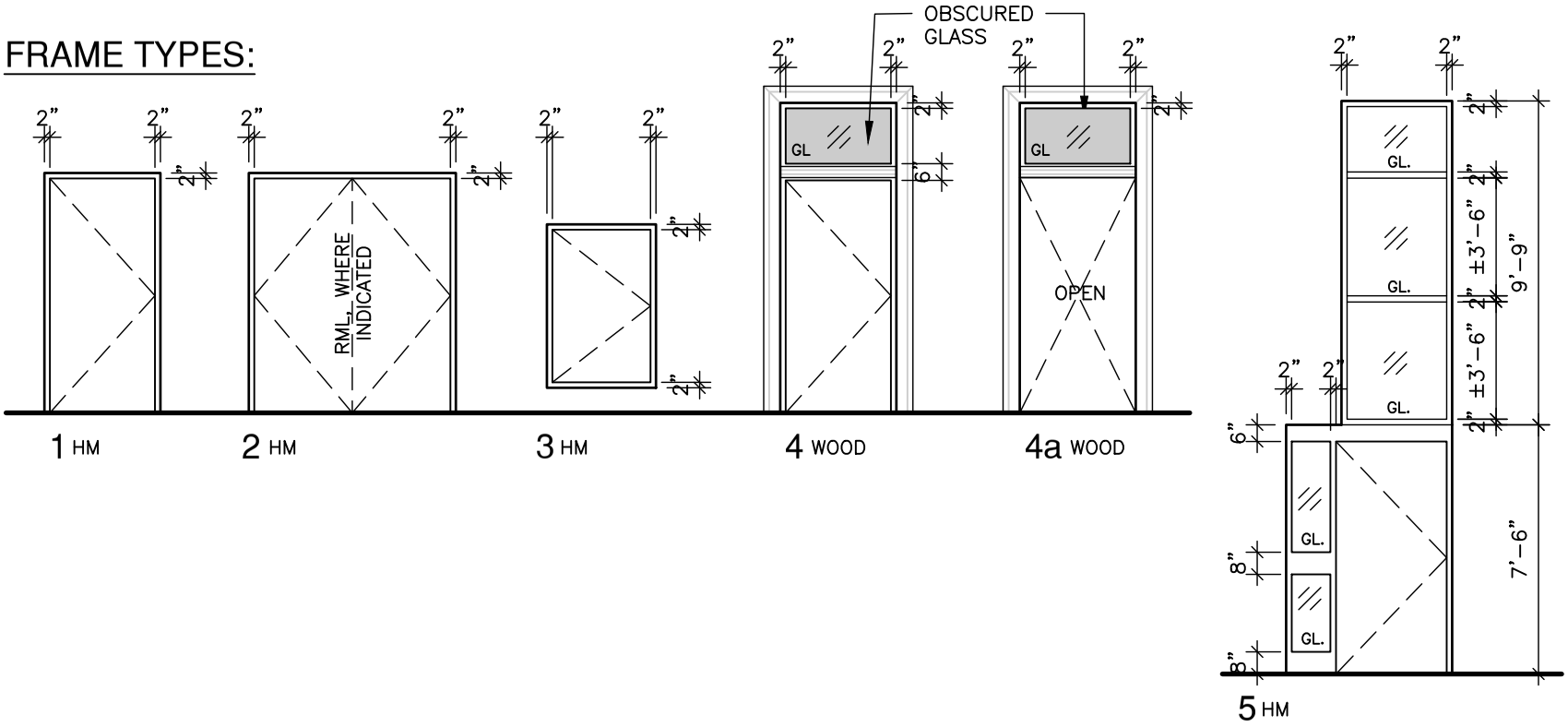
#2624 CITY ARCHIVES BUILDING REDEVELOPEMENT – DOOR & FRAME SCHEDULE													
NUMBER	SIZE	DOOR			FRAME				REMARKS	HARDWARE			
		TYPE	MAT'L	GLASS	TYPE	MAT'L	HEAD	GLASS		POWER	CR	ULC	HDWR
S02A	3'-4"x7'-0"	D	HM	TRG	1	HM	2"	---	CR	●	●	90 MIN	26
S02B	3'-4"x7'-0"	C	HM	TMP-1 HSDG	5	HM	2"	---	INSUL DOOR+FRAME, CR	●			27
S02C	3'-4"x7'-0"	D	HM	TRG	1	HM	2"	---	CR	●	●	90 MIN	26
S02D	3'-4"x7'-0"	D	HM	TRG	1	HM	2"	---	INSUL DOOR+FRAME, CR	●	●	90 MIN	26
S02E	3'-4"x7'-0"	D	HM	TRG	1	HM	2"	---	INSUL DOOR+FRAME, CR	●	●	90 MIN	26
S02F	3'-4"x7'-0"	D	HM	TRG	1	HM	2"	---	INSUL DOOR+FRAME, CR	●	●	90 MIN	26
S02G	3'-4"x7'-0"	D	HM	TRG	1	HM	2"	---	CR	●	●	90 MIN	26
S02H	3'-4"x7'-0"	D	HM	TRG	1	HM	2"	---	INSUL DOOR+FRAME, CR	●	●	90 MIN	26
S03A	3'-2"x7'-0"	D	HM	TRG	1	HM	2"	---	CR	●	●	90 MIN	26
S03B	3'-0"x7'-0"	EXIST WD DOOR			EXIST WD FRAME								04
S03C	2'8"x7'-0"	D	HM	TRG	1	HM	2"	---	CR	●	●	90 MIN	25
S03D	2'-8"x7'-0"	D	HM	TRG	1	HM	2"	---	NEW DOOR+FRAME, EXIST R.O., CR	●		90 MIN	28
S03E	2'-4"x7'-0"	A	HM	---	1	HM	2"	---	NEW DOOR+FRAME, EXIST R.O.				28

#2624 CITY ARCHIVES BUILDING REDEVELOPEMENT – DOOR & FRAME SCHEDULE													
NUMBER	SIZE	DOOR			FRAME				REMARKS	HARDWARE			
		TYPE	MAT'L	GLASS	TYPE	MAT'L	HEAD	GLASS		POWER	CR	ULC	HDWR
BL-01	5'-10"x8'-0"	---	---	---	FR5	ALUM	2.5"	TRG	FRG BORROWED LITE	---	---	90 MIN	24
BL-02	5'-10"x8'-0"	---	---	---	FR5	ALUM	2.5"	TRG	FRG BORROWED LITE	---	---	90 MIN	24
BL-03	3'-8"x9'-4"	---	---	---	FR2	ALUM	2.5"	TRG	FRG BORROWED LITE	---	---	90 MIN	24
BL-04	3'-8"x9'-4"	---	---	---	FR2	ALUM	2.5"	TRG	FRG BORROWED LITE	---	---	90 MIN	24

DOOR TYPES:



FRAME TYPES:



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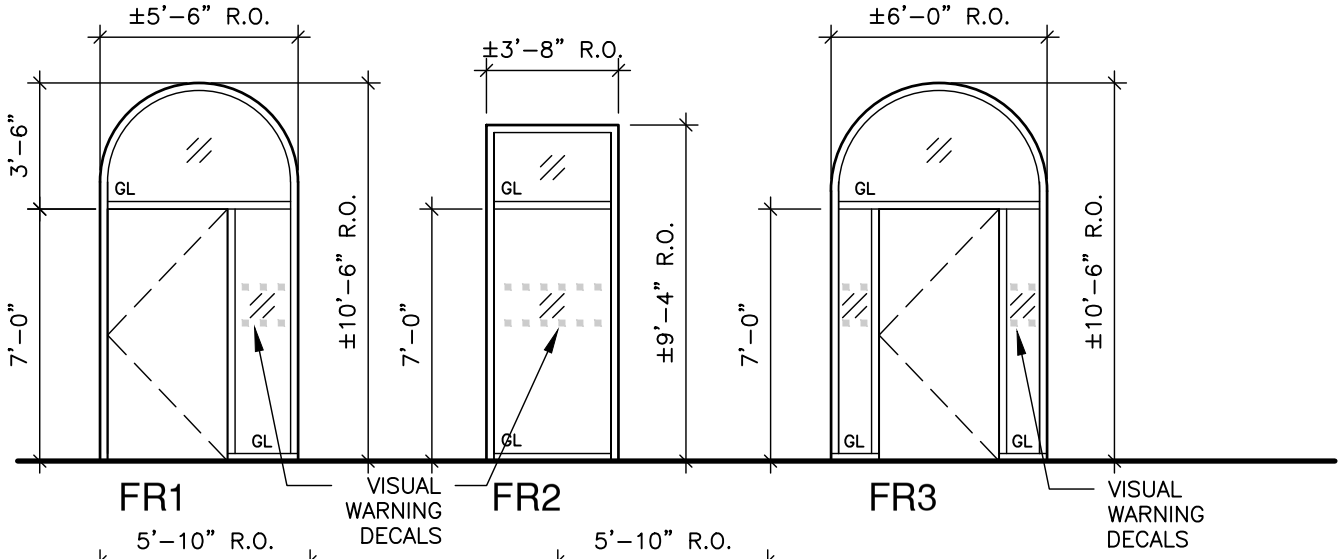
141 st. anne's road, winnipeg, manitoba, R2M 2Z3

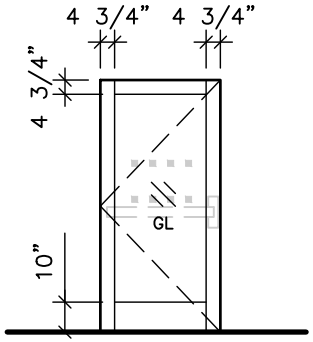
260 - 8th street, brandon, manitoba, R7A 3X3

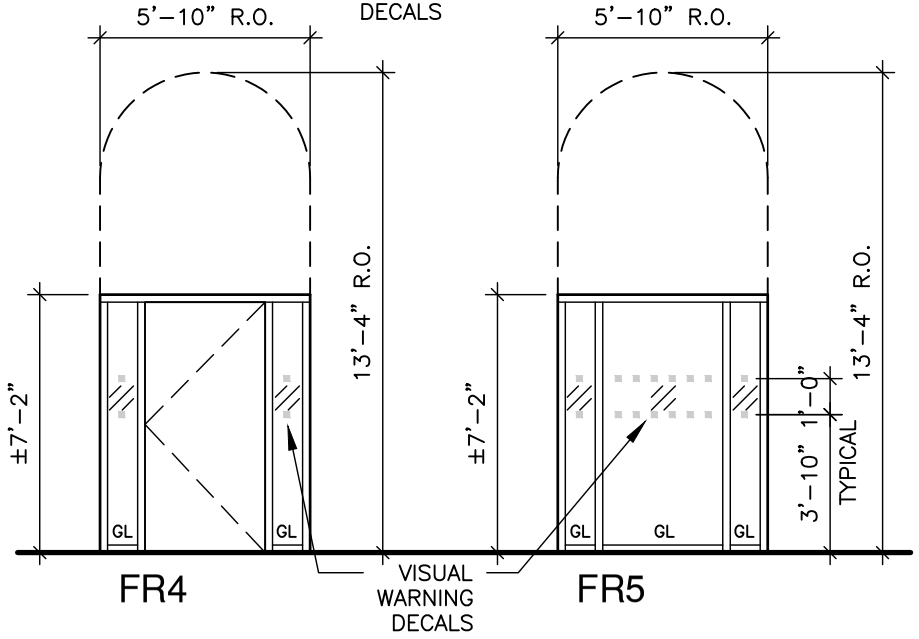
2624

DS-1

FIRE-RESISTIVE DOOR & FRAME TYPES:







VISUAL WARNING DECALS

PROVIDE 2 HORIZONTAL ROWS OF 2"x2" COLOUR CONTRASTING SQUARE DECALS, SPACED 6" O.C. AT EACH GLASS SIDELITE & SCREEN.

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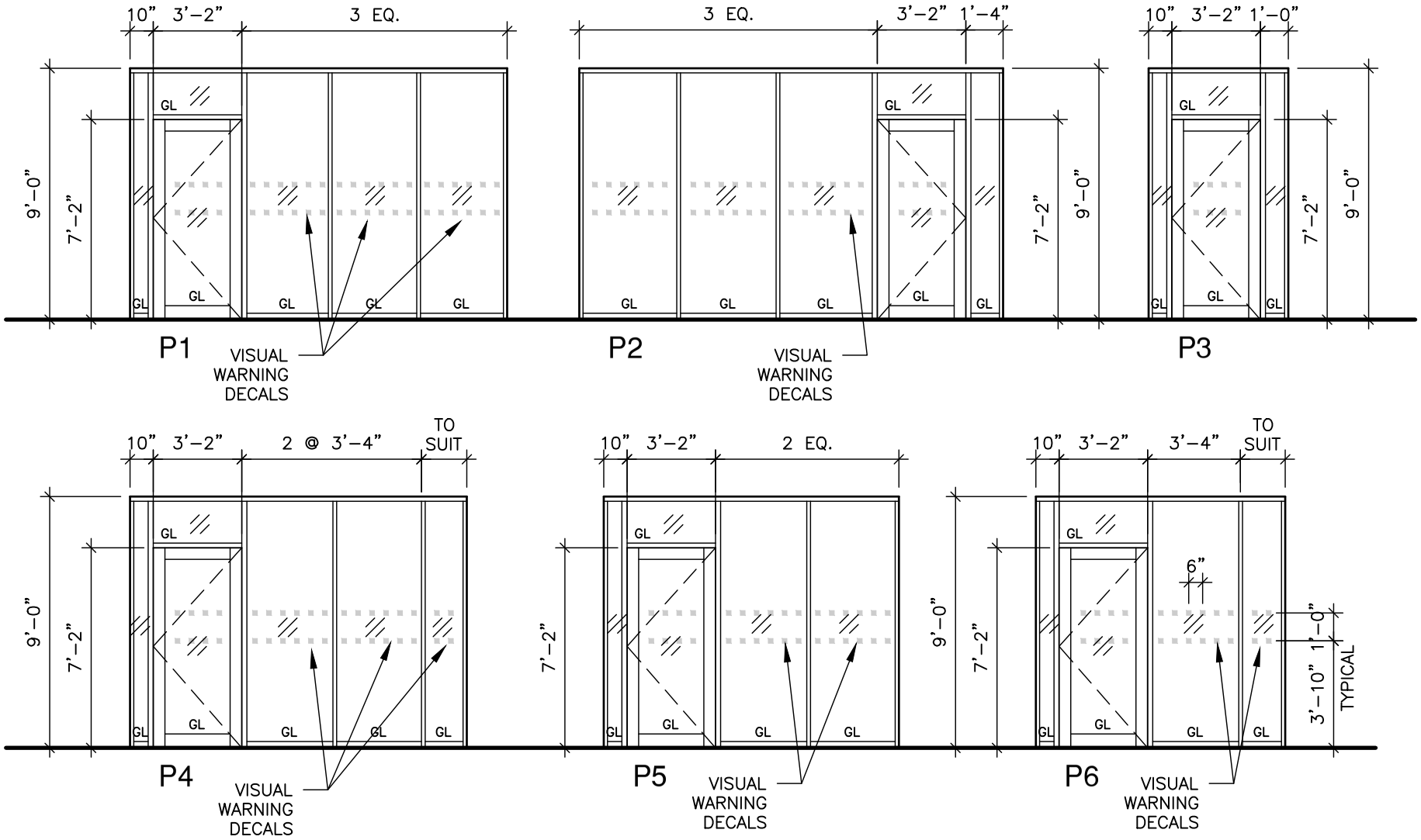
2624

DS-2

GLAZED PARTITION SYSTEM



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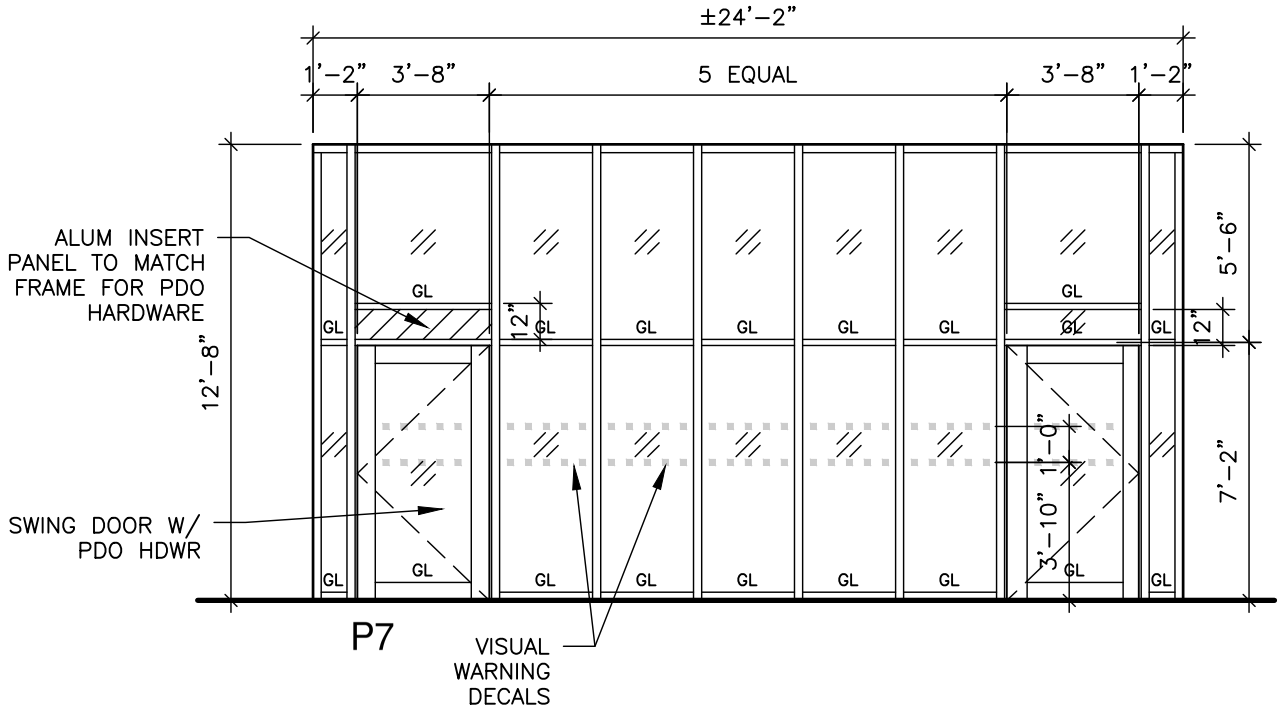
2624

DS-3

GLAZED PARTITION SYSTEM



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260 - 8th street, brandon, manitoba, R7A 3X3

2624

DS-4

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)

.1 ANSI Z97.1 – Standard for Safety Glazing Materials Used in Buildings

.2 American Society for Testing and Materials (ASTM)

.1 ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-12.1 – Tempered or Laminated Safety Glass

.2 CAN/CGSB-12.3 – Flat, Clear Float Glass

.3 CAN/CGSB-12.8 – Insulating Glass Units

.4 CAN/CGSB-19.13 – Sealing Compound, One-Component, Elastomeric, Chemical Curing

.5 CAN/CGSB-19.24 – Multicomponent, Chemical-Curing Sealing Compound

.4 Underwriters Laboratory of Canada (ULC)

.1 ULC 104 – Standard Method of Fire Tests of Door Assemblies

.2 ULC 106 – Standard Method of Fire Tests of Window and Glass Block Assemblies

1.2 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for glazing for incorporation into manual.

1.3 AMBIENT CONDITIONS

.1 Ambient requirements:

.1 Install glazing when ambient temperature is 10 degrees C minimum. Maintain ventilated environment for 24 hours after application.

.2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

Part 2 PRODUCTS

2.1 DESIGN CRITERIA

.1 Ensure continuity of building enclosure vapour and air barrier using glass and glazing materials as follows:

.1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.

.2 Size glass to withstand wind loads, dead loads and positive and negative live loads to ASTM E330.

.3 Limit glass deflection to 1/200 with full recovery of glazing materials.

2.2 GLASS MATERIALS

.1 All glass to meet Federal Government specifications. Thickness shall be 6mm (1/4") minimum, except as noted. Thickness of exterior window glazing shall be determined by wind/suction loads, whichever is greater, 5mm (1/5") minimum.

.2 Float glass: to CAN/CGSB-12.3, glazing quality.

.3 Safety glass: to CAN/CGSB-12.1, clear, Type 2-tempered, Class B-float.

.4 Rated safety glass (RSG): Firelite NT, 5mm (3/16") thick, to ANSI Z97.1, ULC 104 and ULC 106, as distributed by Technical Glass Products.

.5 Firewall safety glass (TRG): Pilkington Pyrostop Glass, as distributed by Technical Glass Products.

2.3 MILLWORK GLASS

.1 Glass shelves: thickness shown, clear, polished plate glass, ground edges.

.2 Glass doors: thickness shown, clear glass, fully tempered, ground edges, complete with grooved finger pulls.

2.4 INSULATED GLASS UNITS

.1 Insulating glass units: to CAN/CGSB-12.8.

.2 Low conductivity spacers: reverse dual seal design consisting of thermoset foam spacer, multi-layer vapour barrier and pre-applied sealant/adhesive for glass bonding requiring a secondary seal.

.1 Standard of acceptance: Edgetech's Super Spacer, or approved equal.

.3 Glazing system, general:

.1 Double fixed hermetically sealed units; use preformed butyl tape, 10-15 durometer hardness, Tremco paper release 440 or Polyshim. Use Monolastimeric or similar for heal bead.

.2 Aluminum sash: use vinyl wrap around glazing splines. Glass readily reglazeable on site.

.3 Secure glass with a removable exterior aluminum glass stop, and double-sided foam tape on the interior and thermoplastic rubber on the exterior. Reglazeable on site.

.4 Double glazed units: at exterior doors, 25mm overall thickness.

.1 Hermetically sealed units, double glazed, minimum 6mm thick with 12.7mm air space.

.2 Exterior pane clear, annealed.

.3 Interior pane clear, annealed, with low 'E' coating, Solarban 60 on exterior face (#3).

.4 Fill glass cavity with argon gas.

2.5 GLAZING AND SEALING COMPOUND MATERIALS

.1 Sealant compound: one (1) component silicone base, solvent curing, colour to be selected.

.2 Glazing tape: preformed butyl tape, 10-15 durometer hardness, paper release, selected colour.

.3 Glazing tape for rated safety glass: closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two (2) sides, maximum water absorption by volume of 2 percent.

.1 Glass panels that exceed 1,296 sq. inches for 45-minute ratings must be glazed with fire-rated glazing tape supplied by manufacturer.

.2 Glass panels that exceed 1,393 sq. inches for 90-minute ratings must be glazed with fire-rated glazing tape supplied by manufacturer.

.4 Setting blocks: neoprene, Shore "A" durometer hardness 70-90, 100mm (4") long x 6mm (1/4") high x width to suit glass thickness.

.5 Spacer shims: neoprene, Shore "A" durometer hardness 50, 75mm (3") long x 24mm (1") thick x 9mm (0.36") high.

.6 Primer-sealers and cleaners: to glass manufacturer's recommendations.

2.6 PRIVACY FILM

.1 Standard of acceptance: 3M Fasara, Frost/Matte, SH2MACR-I "Matte-Crystal-i".

Part 3 EXECUTION

3.1 WORKMANSHIP

.1 Remove protective coatings and clean contact surfaces with solvent and wipe dry.

.2 Apply primer-sealer to contact surfaces.

.3 Place setting blocks as per manufacturer's instructions.

.4 Install glass, rest on setting blocks, push against tape or compound with sufficient pressure to ensure full contact and adhesion at perimeter.

.5 Install removable stops, avoiding displacement of tape or sealant, exert pressure for full continuous contact.

.6 Provide edge clearance of 6mm (1/4") minimum, except where indicated otherwise.

.7 Insert spacer shims to centre glass in space, as recommended by manufacturer. Place shims at 300mm (12") on centre, and keep 6mm (1/4") below sight line.

.8 Apply cap bead of sealant at exterior void.

.9 Apply sealant to uniform and level line, flush with sightline, and tooled or wiped with solvent to smooth appearance.

.10 Do not cut or abrade tempered, heat-treated, or coated glass.

3.2 EXTERIOR GLAZING

.1 Hollow metal: combination method – tape/sealant:

.1 Cut glazing tape to proper length and set against permanent stops, 5mm (1/5") below sightline. Install horizontal strips first, extend over entire width of opening before applying vertical strips. Weld corners together by butting tape and dabbing with sealant.

.2 Fill gap between glass and applied stop with specified sealant to depth equal to bit of frame on glass but not more than 3mm (1/8") below sightline.

3.3 INTERIOR GLAZING

.1 Wet method – tape/tape:

.1 Cut glazing tape to length and install against permanent stop, project 1.5mm (1/16") above sightline.

.2 Place glazing tape on free perimeter of glass in same manner as described above.

3.4 INSTALLATION: PRIVACY FILM

.1 Install plastic film with adhesive, applied in accordance with film manufacturer's instructions.

.2 Place without air bubbles, creases or visible distortion.

.3 Fit tight to glass perimeter with razor cut edge.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 After installation, mark each light with an "X" by using removable plastic tape or paste.

.1 Do not mark heat absorbing or reflective glass units.

.3 Repair damage to adjacent materials caused by glazing installation.

3.6 FINISHING

.1 Immediately remove sealant and compound dropping from finished surfaces. Remove labels after Work is completed.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American Society of Testing and Materials (ASTM)

- .1 ASTM C35 – Standard Specification for Inorganic Aggregates for Use in Gypsum Plaster
- .2 ASTM C842 – Standard Specification for Application of Interior Gypsum Plaster

1.2 QUALITY ASSURANCE

.1 Qualifications: Work to be undertaken by skilled personal with a minimum five (5) years' experience, references to be made available upon request.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

- .1 Ensure bagged materials are delivered to site and stored in original containers.
- .2 Ensure loose material is delivered, clean, and stored to prevent contamination by foreign material.
- .3 Protect material from damage by moisture and freezing.

1.4 AMBIENT CONDITIONS

.1 Do plaster work when ambient temperature is between 13 degrees C and 21 degrees C under conditions specified in ASTM C842.

.2 Ventilate and heat to facilitate proper application and curing of plaster.

- .1 Ensure that high temperatures do not effect plaster drying process when spotlights are used during repair of existing plaster.

.3 Maintain air moisture content at 15% relative humidity to facilitate proper curing of plaster and minimize cracking.

- .1 Keep records of actual air moisture content for specified period of cure.

Part 2 Products

2.1 MATERIALS

.1 Existing lath: if existing lath is damaged, provide new to match existing type.

.2 Gypsum plaster: to ASTM C842.

.1 Gypsum gauging plaster, gauging plaster, plaster of paris, Gypsum Keene's Cement (anhydrous calcined gypsum): to ASTM C842.

.3 Sand: to ASTM C35. Clean, sharp, free from deleterious matter.

.4 Water: potable, free of substances that would affect set of plaster.

.5 Fibres: if required to match existing, clean, 13 to 51mm long, free from grease, dry.

2.2 MIXES

.1 Traditional plaster mix: proportion mix by volume as specified.

.1 Scratch coat: 1 gypsum to 2 sand with 5.3kg fibres per m^3 plaster; water as required to achieve proper consistency.

.2 Brown coat: 1 gypsum to 3 sand with 2.7kg fibres per m^3 plaster; water as required to achieve proper consistency; colour: to match existing.

.3 Finish coat: 1 lime to 2.5 Plaster of Paris; water as required to achieve proper consistency.

.2 Substitutes:

.1 Base coat: exterior grade, premixed plastering cement and reinforced with 0.3% to 0.5% (by weight) chopped glass fibre, 25mm to 75mm long.

.2 Brown coat: exterior grade, premixed, white finishing plaster.

.3 Finishing coat: exterior grade, premixed, finishing plaster.

.3 Mix plaster in accordance with ASTM C842 unless otherwise specified] [premixed plaster manufacturer's written recommendations].

.4 Accurately maintain measuring proportions from batch to batch.

.5 Have materials hand mixed.

Part 3 Execution

3.1 SITE VERIFICATION OF CONDITIONS

.1 Examine and report in writing to Contract Administrator areas of deteriorated plaster not previously identified.

.2 Obtain Contract Administrator's approval and instructions for repair and replacement of plaster before proceeding with repair work.

3.2 PROTECTION

.1 Protect any fittings and surfaces adjacent to work by covering or masking.

3.3 PREPARATION

.1 Remove existing plaster and patch deteriorated areas as indicated on Drawings.

.2 Clean out plaster between existing lath and brush out loose sand.

.3 Bevel edges of existing plaster to accept new plaster repair.

.4 Obtain approval from Contract Administrator of preparation work prior to proceeding with installation.

3.4 INSTALLATION

.1 Repair of lath.

- .1 Remove and replace damaged, rotted or corroded lath, using new lath to match existing.
- .2 Lath spacing: same as existing original.

.2 Install gypsum to ASTM C842.

3.5 APPLICATION

.1 Ensure that plaster finish follows original methods to maintain appearance of original work.

.2 Do plaster work to ASTM C842, unless otherwise specified.

.3 Scratch coat:

- .1 Apply specified scratch coat with trowel, using sufficient pressure to force it between gaps of lath. Ensure even surface.
- .2 Scratch surface with broom when initial set is obtained (2-4 days).
- .3 Keep scratch coat damp for 3 days.
- .4 Cure scratch coat 10 days in ventilated surroundings.

.4 Intermediate brown coat:

- .1 Wet scratch coat before application of brown coat.
- .2 Apply brown coat.
- .3 Keep brown coat damp for 2 days.
- .4 Cure brown coat sufficiently.

.5 Finish coat:

- .1 Wet intermediate brown coat thoroughly. Eliminate standing water from surface.
- .2 Apply specified finish coat to minimum 3mm thickness.
- .3 Smooth finish coat with trowel to achieve desired texture and appearance.
- .4 Cure finish coat sufficiently.
- .5 Trowel patch work to smooth surface, even with adjacent work.

3.6 CLEANING

.1 Remove droppings and splashings, immediately, using clean sponge and water.

3.7 PROTECTION

.1 Protect finished adjoining work, during execution of plaster work, with polyethylene sheets or building paper.

.2 Remove surplus material, tools, equipment and debris from work area on completion of work.

3.8 CURING

.1 Cure plaster for minimum of 7 days.

.2 Maintain temperature between 13 and 21 degrees C.

.3 Maintain relative humidity between 30% and 40%.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM)

- .1 ASTM C475/C475M – Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board
- .2 ASTM C840 – Standard Specification for Application and Finishing of Gypsum Board
- .3 ASTM C1002 – Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
- .4 ASTM C1177/C1177M – Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
- .5 ASTM C1396/C1396M – Standard Specification for Gypsum Board

.2 The Manitoba Wall and Ceiling Association Inc. (MWCA)

- .1 MWCA Specification Standards Manual

1.2 QUALITY ASSURANCE

.1 Perform gypsum board Work in accordance with the MWCA specification standards manual.

.2 Contractor shall be a member in good standing of the Manitoba Wall and Ceiling Association Inc.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials in original packages, containers or bundles bearing manufacturer's brand name and identification.

.2 Store materials inside, level, and under cover. Keep dry. Protect from weather, other elements and damage from construction operations and other causes.

.3 Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal accessories and trim from being bent or damaged.

1.4 ENVIRONMENTAL REQUIREMENTS

.1 Maintain temperature minimum 10°C, maximum 21°C for 48 hours prior to, and during, application of gypsum boards and joint treatment, and for at least 48 hours after completion of joint treatment.

.2 Apply board and joint treatment to dry, frost-free surfaces.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Gypsum board: to ASTM C1396/C1396M, type “x”, 13mm (1/2”) and 16mm (5/8") thick as noted, 1200mm (4ft) wide by maximum practical length, ends square cut, edges tapered, as indicated on plans.

.2 Cavity shaft wall: non-load bearing gypsum board partition assembly designed for erection from outside the shaft, consisting of Sheetrock Brand Firecode “C” Gypsum Panels, steel studs and runners, and CGC Shaft Wall Liner. Standard of acceptance: CGC Cavity Shaft Walls, or approved equal.

.3 Glass-mat gypsum sheathing board: to ASTM C 1177/C1177M, with water-resistant treated core, surfaced with glassmat facings and bond-enhancing primer coating, thickness as indicated. Standard of acceptance: DensGlass Gold Exterior fireguard paperless sheathing panel, as manufactured by G-P Gypsum, or approved equal.

2.2 FASTENINGS AND ADHESIVES

.1 Nails, screws and staples: to ASTM C1002.

.2 Screws for fiberglass-mat faced gypsum sheathing board: ASTM C1002, corrosion resistant treated.

.3 Laminating compound: to ASTM C475/C475M, asbestos free.

2.3 ACCESSORIES

.1 Casing beads, corner beads fill type: 0.5mm (0.019") base thickness commercial grade sheet steel with G90 zinc finish, perforated flanges; one (1) piece length per location.

.2 Polyethylene: (at control joints) 0.10mm or 0.15mm (4 mil or 6 mil) thick.

.3 Joint compound: to ASTM C475/C475M, asbestos free.

.4 Joint compound for glass-mat faced gypsum board: to ASTM C475/C475M, type as recommended by gypsum sheathing board manufacturer.

.5 Joint tape: type as recommended by gypsum board manufacturer.

.6 Joint tape for glass-mat faced gypsum board: to ASTM C475/C475M, type as recommended by gypsum sheathing board manufacturer.

2.4 ACOUSTICAL SEALANTS

.1 Acoustical sealant: to Section 07 92 00, Joint Sealants.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Do not apply boarding until bucks, anchors, blocking, electrical and mechanical Work have been reviewed.

3.2 GYPSUM BOARD APPLICATION

.1 Start gypsum board at 10mm (3/8") above floor surface (see spec. detail).

.2 Apply gypsum board to wood and steel furring or framing using screw fasteners for first layer, and laminating adhesive for the second layer.

.3 Apply 13mm (1/2") bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut other fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, etc., in partitions where perimeter sealed with acoustical sealant (see spec. detail).

.4 Apply rated gypsum board to obtain ratings as indicated.

3.3 ACCESSORIES

.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150mm (6") on centre using contact adhesive for full length.

.2 Install casing beads around perimeter of suspended ceilings.

.3 Install casing beads wherever gypsum board butts against surfaces having no trim concealing junction and where indicated. Caulk joints with sealant.

3.4 TAPING AND FILLING

.1 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer’s directions and feathered out onto panel faces.

.2 Finish corner beads, control joints and trim as required with two (2) coats of joint compound and one (1) coat of taping compound, feathered out onto panel faces.

.3 Fill screw head depressions with joint and taping compounds to bring flush adjacent surface of gypsum board so as to be invisible after painting is completed.

.4 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.5 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for painting.

3.5 ACCESS DOORS

.1 Install access doors, where indicated, and to electrical and mechanical fixtures specified in respective Sections.

.2 Rigidly secure frames to furring or framing systems, tight and flush to face of gypsum board.

3.6 CONTROL JOINTS

.1 Construct control joints of two (2) back-to-back casing beads set in gypsum board facing and supported independently on both sides of joint.

.2 Provide continuous polyethylene dust barrier behind and across control joints.

.3 Locate control joints where indicated, at changes in substrate construction, at maximum 9m (30ft) spacing on long runs, and at maximum 15m (50ft) spacing on ceilings.

.4 Install control joints straight and true.

.5 Rake out mud from joint to leave a clean joint.

3.7 SOUND PARTITIONS

.1 Fill stud space with insulation.

.2 Seal perimeter of gypsum board with acoustical sealant.

.3 Tape and fill joints in sound attenuation partitions above ceilings to spec. detail.

3.8 FIRE RATED PARTITIONS

.1 Tape and fill joints in fire rated partitions above ceilings to spec. detail.

3.9 PATCHING EXISTING PLASTER

.1 Refer to Section 09 03 25 – Conservation Treatment for Period Plastering.

3.10 CAVITY SHAFT WALL

.1 Install in strict accordance with manufacturer’s instructions.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society of Testing and Materials (ASTM)

- .1 ASTM C645 – Standard Specification for Non Structural Steel Framing Members
- .2 ASTM C754 – Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
- .3 ASTM C1002 – Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

1.2 QUALITY ASSURANCE

.1 Do work to Section 9.25, Sheet Steel Stud Wall Framing, of the Manitoba Building Code (MBC) as supplemented herein.

.2 Materials shall conform to applicable sections of ASTM C645.

.3 Installation shall be in accordance with ASTM C754.

Part 2 PRODUCTS

2.1 FRAMING AND FASTENERS

.1 Non-load bearing channel stud framing: to ASTM 645.

.2 Fasteners: to ASTM C1002.

2.2 SIZE OF FRAMING

.1 Except as otherwise specified herein the size and spacing shall conform to the following:

- .1 Maximum stud spacing 400mm (16") on centre
- .2 Minimum stud size 31mm x 40mm (1-1/4" x 1-5/8"), maximum wall height 3m (10 ft)
- .3 Minimum stud size 31mm x 63mm (1-1/4" x 2-1/2"), maximum wall height 4m (13 ft)
- .4 Minimum stud size 31mm x 91mm (1-1/4" x 3-5/8"), maximum wall height 5.2m (17 ft)

.2 Interior non-loadbearing partition studs shall have a minimum metal thickness of 0.50mm (26 gauge) Nominal Base Steel Thickness (NBST), except 150mm (6") studs shall have a minimum metal thickness of 0.91mm (20 gauge) NBST.

.3 Exterior wall studs shall be 150mm (6") studs, and shall have a minimum metal thickness of 0.91mm (20 gauge) NBST, unless noted otherwise.

.4 Runners for interior non-loadbearing walls shall have a minimum thickness of 0.45mm (26 gauge) NBST. Flanges shall be 25mm (1") for installation at floor and 50mm (2") at top (to allow for deflection), in widths to suit stud sizes.

.5 Metal channel stiffener: 38mm x 10mm, 1.2mm NBST (1-1/2" x 3/8", 18 gauge) cold rolled steel, coated with rust inhibitive coating. Provide a horizontal row at 1200mm (48") centres.

.6 Furring channel: to ASTM C645 channel shape, knurled face, 0.55mm NBST, 22mm depth x 66mm wide (25 gauge, 7/8" x 2-5/8"). Clips of 2.5mm (12 gauge) wire.

.7 Resilient furring channel: for use on wood, not for direct application to steel studs. Purpose made, 0.55mm NBST, 13mm depth x 63mm (25 gauge, 1/2" x 2-1/2").

2.3 SEALANTS

.1 Sealants to Section 07 92 00, Joint Sealants.

.2 Sill plate gasket: 6mm (1/4") thick polyethylene foam, width as indicated.

.1 Standard of acceptance:

.1 Owens Corning FoamSealR Sill Gasket

.2 Protecto Wrap Energy Plate Liner

Part 3 EXECUTION

3.1 STUD ERECTION

.1 Align partition tracks at floor and ceiling and secure at 600mm (24") on centre maximum.

.2 Place studs vertically at 400mm (16") on centre, unless otherwise noted, and not more than 50mm (2") from abutting walls and corners. Position studs in tracks at floor and ceiling, cross brace studs.

.3 Erect metal studding to tolerance of 1:1000.

.4 Attach studs to bottom track to manufacturer’s instructions.

.5 Coordinate simultaneous erection of stud with installation of service lines. When erecting studs, ensure web openings are aligned.

.6 Coordinate erection of studs with installation of door and window frames and special supports or anchorage for Work specified in other Sections.

.7 Provide two (2) studs extending full height of wall at each side of all openings wider than stud centres specified.

.8 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs. Secure track to studs at each end, in same manner and spacing as wall studs. Install intermediate studs above and below openings in same manner and spacing as wall studs.

.9 Extend partitions to underside of structure, except where noted otherwise on drawings.

.10 Maintain clearance under beams and structural slabs to avoid transmissions of structural loads to studs. Use 50mm (2") leg ceiling tracks.

.11 Install continuous insulating strips to isolate studs from un-insulated surfaces.

.12 Install steel studs or furring channels between studs for attaching electrical and other boxes.

.13 Install sill plate gasket under all steel stud partitions for acoustical attenuation.

3.2 FURRING

.1 Furring indicated on drawings is schematic.

.2 Allow for Contract Administrator's review prior to boarding over bucks, anchors, blocking, electrical and mechanical Work.

.3 Leave finished Work rigid, secure, square, level, plumb and erected to maintain finish plaster line dimensions and contours. Make allowance for thermal movement.

.4 Provide clearance under beams and structural slabs to prevent transmission of structural loads to vertical furring.

3.3 CEILING AND SOFFIT FURRING

.1 Install runners level to tolerance of 1:1200, 3mm: 3600mm. Provide runners at interruptions of continuity and change in direction.

.2 Frame perimeters of openings, with furring channels, to accommodate access panels, light fixtures, diffusers, grilles, etc.

.3 Furr for vertical bulkheads within or at termination of ceilings.

3.4 ACCESS DOORS

.1 Install access doors to electrical and mechanical fixtures specified in respective Sections.

.2 Rigidly secure frames to furring or framing systems.

3.5 BRACING

.1 Provide steel stud bracing as required for top of toilet partition pilasters. Bracing to receive bolts through holes by partition installer.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)

.1 ANSI A118.1 – Specifications for Dry-Set Portland Cement Mortar

.2 Terrazzo, Tile and Marble Association of Canada (TTMAC)

.1 TTMAC Tile Installation Manual Standards

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide in accordance with Section 01 33 00 – Submittal Procedures.

.2 Samples:

.1 Submit duplicate 600mm x 600mm (2ft x 2ft) sample panels of each colour, texture, size and pattern of porcelain tile.

.2 Adhere tile samples to 10mm (3/8”) thick plywood and grout joints to represent project installation.

1.3 ENVIRONMENTAL REQUIREMENTS

.1 Maintain air temperature and structural base temperature at installation area above 10°C for 24 hours before, during, and 48 hours after, installation.

1.4 MAINTENANCE DATA AND MATERIALS

.1 Maintenance data:

.1 Provide maintenance data for The City’s use.

.2 Maintenance materials:

.1 Provide minimum two percent (2%) of each type and colour of porcelain tile required for project maintenance use. Store where directed.

.2 Maintenance material to be of same production run as installed material.

Part 2 PRODUCTS

2.1 TILE

.1 Floor tile: Olympia Tile, Regal Series, matte finish, 60cm x 60cm (24”x24”), or approved equal.

.1 Approved equal: Milliken – “Formwork”

2.2 SETTING MATERIALS

.1 Water: potable, and free of minerals, which may discolour mortar.

.2 Dry-set mortar: to ANSI A118.1, for floors and walls. Premix pre-sanded dry mix to be added to water.

.3 Thin set mortar additive: formulated for use with dry-set mortar and thin-set bond coat.

2.3 GROUT AND SEALANT

.1 Grout: colours to be selected from manufacturer's full range of colours.

.1 Flextile: 600 Polymer Modified, sanded grout for floors

.2 Profix: Poly 500, sanded polymer grout for floors

.2 Sealant: silicone, one (1) part; mildew-resistant.

2.4 PROTECTIVE MATERIALS

.1 Neutral cleaner such as "Hillyard Super Shine-All", or "Tilelab Grout and Tile Cleaner", or approved equal.

.2 Heavy-duty non-staining construction paper with compatible masking tape.

2.5 SEALER

.1 TileLab Penetrating Sealer, by Custom Building Products, pH neutral and non-abrasive, or approved equal.

Part 3 EXECUTION

3.1 WORKMANSHIP

.1 Do tile Work in accordance with tile installation manual, produced by Terrazzo, Tile and Marble Association of Canada (TTMAC), thin-set method, except where specified otherwise.

.2 Apply bond coat to non-frozen, frost-free surface.

.3 Fit tile units around corners, fitments, fixtures, drains and other built-in objects. Maintain uniform joint appearance. Make cut edges smooth and even, and free from chipping. Edges resulting from splitting not acceptable.

.4 Maximum surface tolerance: 1:800.

.5 Make joints between tiles uniform and approximately 6mm (1/4") wide, plumb, straight, true, even and with adjacent units flush. Align patterns.

.6 Lay out units so perimeter tiles are minimum one-half (1/2) size.

.7 Sound tiles after setting and replace hollow sounding units to obtain full bond.

.8 Make internal angles square, and external angles rounded.

.9 Seal grouted joints with sealer.

.10 Clean installed tile surfaces after installation cured.

.11 Terminate flooring at centerline of door in openings where adjacent floor finish, colour, or material is dissimilar.

.12 Install control joints, edges and trims, as indicated or as required.

3.2 SETTING SYSTEM

.1 Install tile on substrate in accordance with TTMAC details.

3.3 SEALER

.1 Apply sealer to tile surfaces in accordance with manufacturer's specifications.

3.4 PROTECTION OF FINISHED WORK

.1 Protect new floors from time of final set of adhesive after application of sealer and protective coating, until application of final sealer and protective coating final inspection.

.2 Prohibit traffic on floor for 48 hours after installation.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C635/C635M – Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceiling

.2 ASTM C636/C636M – Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels

.3 ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials

.4 ASTM E1264 – Classification for Acoustical Ceiling Products

.2 Canadian Standards Association (CSA)

.1 CSA B111 – Wire Nails, Spikes and Staples

.3 Underwriters' Laboratories of Canada (ULC)

.1 ULC 102 – Method of Test for Surface Burning Characteristics of Building Materials

1.2 QUALITY ASSURANCE

.1 Fabrication: to ASTM C635/C635M.

.2 Installation: to ASTM C636/C636M, except where specified otherwise.

.3 Acoustic ceiling tiles and suspension systems shall be provided by the same manufacturer.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Obtain samples of each type of light fixture, diffuser, speaker, and sprinkler head to be installed for preparing factory cut-outs.

.2 Coordinate suspension system with location of related components, including, but not limited to, mechanical, electrical, and communication fixtures. Centre light fixtures, diffusers, speakers, and sprinkler heads in ceiling components.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00, Submittal Procedures.

.2 Samples: submit duplicate samples of each type of acoustical units.

.3 Shop Drawings:

.1 Suspension grid:

.1 Submit reflected ceiling plans for special grid patterns as indicated.

.2 Indicate lay-out, insert and hanger spacing and fastening details, splicing method for main and cross runners, change in level details, acoustical unit support at ceiling fixture, lateral bracing and accessories, attachment system, and methods of installation.

.2 Panels and tiles:

.1 Indicate each type of ceiling material, location, design of units, methods of installation.

.2 Show sizes, and arrangement of ceiling materials on reflected ceiling plans, relating to lighting fixtures, other items.

1.5 ACOUSTICAL UNIT MAINTENANCE MATERIALS

.1 Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

.1 Turn over open cartons of ceiling tile to The City.

.2 Provide 2% overage of gross ceiling for each pattern and type required for project, in sealed cartons.

.3 Store where directed by The City.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

.2 Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

.3 Handle acoustical panels carefully to avoid chipping edges or damaging units.

1.7 ENVIRONMENTAL CONDITIONS

.1 Commence installation after building enclosed and dust generating activities completed.

.2 Permit wet Work to dry before commencement of installation.

.3 Maintain uniform minimum temperature of 15ºC and relative humidity of 20% to 40% before, and during installation.

.4 Store materials in work area 48 hours prior to installation.

Part 2 PRODUCTS

2.1 SUSPENSION SYSTEM DESIGN CRITERIA

.1 Maximum deflection: 1/360th of span to ASTM C635 deflection test.

2.2 SUSPENSION SYSTEM MATERIALS

.1 Intermediate duty system to ASTM C635.

.2 Basic materials for suspension system: commercial quality cold-rolled steel, zinc coated.

.3 Non-fire-rated suspension system: two (2) directional exposed tee bar grid.

.4 Exposed tee bar components: shop painted satin sheen. Components die cut. Main tee with double web, rectangular bulb and 25mm (1") rolled cap on exposed face. Cross tee with rectangular bulb; web extended to form positive interlock with main tee webs; lower flange extended and offset to provide flush intersection. Corner pieces to suit.

.5 Hangers: galvanized soft annealed steel wire, 2.4mm (0.096") thick.

.6 Accessories: splices, clips, wire ties, retainers, corners, and wall mouldings, to compliment suspension system components, as recommended by system manufacturer.

.7 Standard of acceptance: CertainTeed Narrow Reveal Corner Bevel 9/16" EZ Stab Elite Narrow, or approved equal. Suspension systems by Armstrong and CGC are approved equal.

2.3 ACOUSTICAL TILES NON-RATED

.1 **ACT-1:** Acoustic lay-in units for non-rated (Class A) suspended ceiling system. Standard of acceptance: CertainTeed, Symphony m High NRC, 1222BF-85-1, or approved equal. Products meeting the same performance characteristics by CGC and Armstrong are approved equal.

- .1 Material: mineral fiber
- .2 Classification (to ASTM E1264): Type IV, Form 2, Pattern E
- .3 Flame spread rating (to ASTM E84 and ULC 102):
  - .1 ULC Class A, 25 or less
  - .2 Flame spread: 25 or less
  - .3 Smoke developed: 50 or less
- .4 Size: 610mm x 610mm x 22mm (2ft x 2ft x 7/8") thick
- .5 Edge: narrow reveal
- .6 Colour: white
- .7 NRC: 0.85 (minimum 0.80 required)
- .8 CAC: 35

.2 **ACT-2:** Acoustic lay-in units for non-rated (Class A) suspended ceiling system. Standard of acceptance: CertainTeed, Symphony m High NRC, 1220BF-85-1, or approved equal. Products meeting the same performance characteristics by CGC and Armstrong are approved equal.

.1 Material: mineral fiber

.2 Classification (to ASTM E1264): Type IV, Form 2, Pattern E

.3 Flame spread rating (to ASTM E84 and ULC 102):

.1 ULC Class A, 25 or less

.2 Flame spread: 25 or less

.3 Smoke developed: 50 or less

.4 Size: 610mm x 1220mm x 22mm (2ft x 4ft x 7/8") thick

.5 Edge: narrow reveal

.6 Colour: white

.7 NRC: 0.85 (minimum 0.80 required)

.8 CAC: 35

2.4 ACCESSORIES

.1 Staples, nails, and screws: to CSA B111, non-corrosive finish, as recommended by acoustic unit manufacturer.

Part 3 EXECUTION

3.1 SUSPENSION SYSTEM INSTALLATION

.1 Do not erect ceiling suspension system until anchors, blocking, sound or fire barriers, and electrical and mechanical Work above ceiling is acceptable to the Contract Administrator.

.2 Lay out system according to reflected ceiling plan.

.3 Lay out system parallel to building lines with edge unit not less than 50% of unit width.

.4 Ensure suspended system is coordinated with location of related components.

.5 Install wall mould to provide correct ceiling height. Finished ceiling system to be level within 1:1200. Mitre corners.

.6 Support suspension system (main runners) at 1220mm (4ft) on centre maximum, with hanger wire from building structural system. Completed assembly to support superimposed loads, such as lighting fixtures, diffusers, grilles and speakers.

.7 Support light fixtures with supplemental hangers within 150mm (6") of each corner and at maximum 610mm (2ft) around perimeter of fixture.

.8 Interlock cross member to main runner to provide rigid assembly.

.9 Install suspension assembly to manufacturer's instructions.

.10 Frame at openings for light fixtures and at changes in ceiling heights.

.11 Support suspension system at maximum distance from walls and columns to minimize distortion from roof structure deflection.

3.2 ACOUSTICAL UNIT INSTALLATION

.1 Ensure substrate surface is level to 1:1000.

.2 Install adhesive bonded acoustic units to clean, dry and firm substrate.

.3 Commence installation following inspection of anchors, blocking, sound or fire barriers, and mechanical and electrical Work above ceiling. Allow for review by Contract Administrator.

.4 Install acoustic units parallel to building lines with edge unit not less than 50% of unit width.

.5 Scribe acoustic units to fit adjacent Work. Butt joints tight, and terminate edges with moulding.

.6 Install flush edge moulding at junction of acoustical unit ceiling and other materials around entire length of joint. Secure to construction. Butt joints neatly, square and true in alignment.

3.3 INTERFACE WITH OTHER WORK

.1 Co-ordinate ceiling work to accommodate components of other sections, such as light fixtures, diffusers, speakers, sprinkler heads, to be built into ceiling components.

3.4 CLEANING

.1 Touch up scratches, abrasions, voids and other defects in painted surfaces on suspension system.

.2 Clean down materials, leave free of grime, dirt, fingerprints, other evidence of work.

END OF SECTION

Part 1 GENERAL

1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide samples in accordance with Section 01 33 00, Submittal Procedures.

.2 Samples: submit 300mm (12") square pieces of specified sheet material.

1.2 ENVIRONMENTAL REQUIREMENTS

.1 Air temperature and substrate temperature at flooring installation area must be above 20°C for 72 hours before, during, and 48 hours after installation.

1.3 MAINTENANCE DATA/MATERIALS

.1 Provide maintenance data for The City's use.

.2 Sheet flooring: provide material equal to one percent (1%) of sheet flooring area (minimum 1200mm x 1800mm (4ft x 6ft)) for maintenance use.

.3 Tile flooring: deliver three (3) cartons of each colour, pattern and type of flooring material required for this project for maintenance use only. Store where directed. Clearly identify each box.

.4 Maintenance materials to be same production run as installed materials.

1.4 WARRANTY

.1 The Flooring Contractor and the manufacturer are to jointly warrant this installation against defects in workmanship and material for a period of two (2) years from date of Substantial Completion.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Resilient sheet flooring (RSF), Contract Administrator to choose from full pattern and colour range:

.1 Homogenous vinyl: 2.0mm thick, iQ Optima by Tarkett/Johnsonite, or approved equal.

.2 Slip-resistant: 2.0mm thick, Altro Orchestra and Serenade, by Altro Floors, or approved equal.

.2 Resilient rubber flooring (RUB):

.1 Standard of acceptance: Prima Olio Hammered HRTPO, as manufactured by Tarkett/Johnsonite, or approved equal.

.1 Nominal overall thickness: 3.2mm

.2 Size: 305mm x 305mm (12” x 12”) tiles

.3 Allow for up to three (3) colours

.2 Accessories:

.1 Stair, tread and nosing, risers: one-piece coordinating marbelized rubber stair, tread and nosing, hammered finish, complete with 50mm (2”) wide contrasting colour insert

.3 Resilient base:

.1 Self base: flooring coved up wall 100mm (4”), complete with round vinyl resilient cove cap and 22mm (7/8”) radius vinyl cove filler strip (cap not required at toe spaces).

.2 Resilient base (typical, RB): top set coved, 3mm (1/8”) thick, rubber, 100mm (4”) high. Colours to be selected from full range of colours. Standard of acceptance: Johnsonite “Color Match” system, or approved equal.

.3 Resilient millwork base (MWB): to be applied to refinished existing wood baseboards. Standard of acceptance: Tarkett/Johnsonite “Millwork” rubber base, style “Mandalay” (MWH), 4.5” high, or approved equal.

.4 Reducer strips: 25mm (1”) wide, thickness of tile, rubber, colour to be selected from full range of colours. Standard of acceptance: Johnsonite “Color Match” system, or approved equal.

.5 Edge strips: aluminum extruded, beveled bar for transitions of up to 5mm (3/16"), hammered finish, 25mm (1") wide, heavy-duty. Standard of acceptance: CM1196 as distributed by FISC Inc., or approved equal.

.6 Stair safety inserts:

.1 Flooring safety inserts: Treadsafe textured safety tiles, 300mm x 300mm x 3mm thick, colour to be selected from manufacturer’s full colour range, as manufactured by Jacobson Treadsafe Ltd., and as distributed by Erv Parent, or approved equal.

.7 Primers and adhesives:

.1 Waterproof, or types recommended by resilient flooring manufacturer for specific material on applicable substrate, above, on or below grade.

.2 Two-part polyurethane adhesive shall be used in areas with high risk of water or frost penetration, and as follows:

.1 Within 1m (39") of exterior doors

.8 Sub-floor filler: polymer modified cementitious-based floor patch, with acrylic additive. Standard of acceptance: Mapei Plani-Patch, Roberts R-Krete.

Part 3 EXECUTION

3.1 SITE AND SUBSTRATE

.1 Building shall be dry and closed in, with minimum temperature of 18°C. All painting shall be completed.

.2 Store material in area of application 72 hours before application.

.3 Accept or reject concrete substrate as to moisture content and level (± 6mm/3000mm (1/4”/10ft) radius).

.4 Ensure concrete floors exhibit negative alkalinity, carbonization, or dusting.

.5 Ensure smooth, hard surface, without imperfections, which may ‘telegraph’ through the flooring.

3.2 MOISTURE TESTING

.1 Ensure concrete floors are dry (maximum seven percent (7%) moisture content) by using test methods recommended by flooring manufacturer.

3.3 SUBSTRATE PREPERATION

.1 Remove substrate ridges and bumps with power sander.

.2 Fill minor low spots (up to 6mm (1/4”)), cracks, joints, holes and other defects with sub-floor filler.

.3 Clean substrate and apply filler, trowel and float to leave smooth, flat, hard surface. Prohibit traffic until filler cured.

.4 Prime or seal substrate to resilient flooring manufacturer’s recommendations.

3.4 SHEET FLOORING APPLICATION

.1 Install in strict compliance with manufacturer’s current installation specifications, using skilled, trained mechanics.

.2 Unroll and layout strips full length, with seams parallel to building lines to produce a minimum number of seams. Cross-joints are not permitted. Border widths minimum 1/3 width of full material.

.3 Spread adhesive uniformly using recommended trowel and lay strips. Do not spread more adhesive than can be covered by flooring before initial set take place.

.4 Double cut sheet joints and continuously seal. Heat weld sides and seams with manufacturer’s matching vinyl thread with approved heat welding equipment.

.5 As installation progresses, and after installation, roll flooring with a 100 lb (45 kg) roller to ensure full adhesion.

.6 Cut flooring and fit neatly around fixed or excessively heavy objects.

.7 Install feature strips and floor markings where indicated. Fit joints tightly.

.8 Install flooring in pan type floor access covers. Maintain floor pattern.

.9 Continue flooring over areas, which will be under built-in furniture.

.10 Continue flooring through areas to receive movable type partitions without interrupting floor pattern.

.11 Terminate flooring at centerline of door in openings where adjacent floor finish thickness or colour is dissimilar. Note locations where material thickness changes, flooring material on door swing side shall continue to accommodate door drop sound seals.

.12 Install metal edge strips at unprotected or exposed edges where flooring terminates.

.13 Install reducer strips at edge of tile and resilient sheet material, seamless material and tile of different thickness.

.14 Seal with silicone sealant around perimeter at wall-floor joint before installing resilient base and at door frame-floor junction.

3.5 TILE APPLICATION

.1 Thoroughly clean and sweep floor, removing any debris which could ‘telegraph’ or cause a pimpling effect.

.2 Apply adhesive uniformly using recommended trowel in accordance with flooring manufacturer’s instructions. Do not spread more adhesive than can be covered by flooring before initial set takes place.

.3 Lay flooring with joints parallel to building lines to produce symmetrical tile pattern. Border tiles minimum half tile width.

.4 Install flooring to square grid pattern with all joints aligned, tightly butted, with pattern grain alternating to produce basket weave pattern.

.5 Cut tile and fit neatly around fixed or excessively heavy objects.

.6 Cut tile to suit floor grilles to permit flush mounting.

.7 Terminate flooring at centerline of door in openings where adjacent floor finish, colour, or material is dissimilar. Note locations where material thickness changes, flooring material on door swing side shall continue to accommodate door drop sound seals.

.8 Install metal edge strips at unprotected or exposed where flooring terminates.

.9 Install reducer strips at edge of tile and resilient sheet material, seamless material and tile of different thickness.

3.6 BASE APPLICATION

.1 Self base:

.1 Install cove filler strip and provide 100mm (4”) high self-base with cap, mitre inside corners, and fill outside corners.

.2 Rubber base:

.1 Set base in adhesive tightly against wall and floor surfaces. Use lengths as long as practical, but not less than 450mm (18") long.

.3 Mitre internal corners, scribe and wrap around external corners.

.4 Install straight and level to variation of 1:1000.

.5 Scribe and fit to door frames and other obstructions.

.6 Install sheet rubber stringer material at steps on stairs and platform risers and where shown, cut carefully to step profile. Apply before tread and riser is installed.

3.7 STAIRS

.1 Install stair safety inserts in accordance with manufacturer’s recommendations.

3.8 CLEANING AND PREPARATION

.1 On completion of the floor, Contractor shall remove all cuttings, debris, tools, etc., and leave floor and site in a clean, neat condition.

.2 Remove excess adhesive from floor, base and wall surfaces without damage.

.3 Clean floor and base surfaces in strict accordance with flooring manufacturer’s instructions.

3.9 PROTECTION OF FINISHED WORK

.1 Protect new floors with polyethylene cover until just before final cleaning or finish.

.2 Prohibit traffic on floor for 48 hours after installation.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM)

- .1 ASTM C241/C241M – Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic
- .2 ASTM D2370 – Standard Test Method for Tensile Properties of Organic Coatings

.2 Construction Specifications Canada (CSC) Architectural Specification Study on Terrazzo Portland cement, produced in cooperation with Terrazzo, Tile and Marble Association of Canada (TTMAC)

.3 Canadian Standards Association (CSA)

- .1 CAN/CSA-A5/A8/A326 – Portland Cement/Masonry Cement/Blended Hydraulic Cement
- .2 CAN/CSA-A23.1/A23.2 – Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete

1.2 ENVIRONMENTAL REQUIREMENTS

.1 Maintain air temperature and structural base temperature at terrazzo installation area above 10°C for 24 hours before, during and 24 hours after installation.

1.3 MAINTENANCE DATA

.1 Provide maintenance data as set out in TTMAC publication for terrazzo Work for incorporation into maintenance manual.

1.4 WARRANTY

.1 Contractor hereby warrants that terrazzo surfaces will remain sealed for five (5) years from date of Substantial Performance.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Cement: to CAN/CSA-A5, Type 10, colour to match existing.

.2 Sand, fine and coarse aggregates to CAN/CSA-A23.1. Clean, washed, locally available, oval aggregate.

.3 Water: potable.

.4 Marble chips: uniform, sound and abrasion resistant to ASTM C241. Grade chips in accordance with TTMAC standards. No deleterious or foreign matter.

.5 Pigments: non-fading mineral pigments to match existing colours, compatible with Portland cement. Alkali-resistant, colour-stable, lime-proof mineral.

.6 Epoxy bonding agent: two (2) components, epoxy resin and epoxy hardener conforming to following performance properties after cure schedule of 28 days at 25°C.

.1 Viscosity: mixed viscosity not less than 0.04Pa.s or more than 0.5Pa.s

.2 Gel time: not less than one-half (1/2) hour at 20°C

.3 Flexibility: Gardiner flexibility test, passes bending over 12mm (1/2") mandrel, without cracking

.4 Elongation: to ASTM D2370, minimum ten percent (10%)

.5 Bond strength: 2MPa, with one hundred percent (100%) concrete failure at minimum coverage, test concrete specimen minimum compressive strength 20MPa

.6 Coverage: 0.3L/m^2 minimum, dry film thickness not less than 0.2mm (0.008")

.7 Divider strips: to match existing in size, colour and type.

.8 Curing compound: to manufacturer's standard.

.9 Cleaning compound: to TTMAC standards.

.10 Sealing and finishing compounds: to TTMAC standards.

2.2 MIXES

.1 Underbed: one (1) part cement to four (4) parts sand by volume.

.2 Terrazzo topping: to match existing colour and strip pattern.

Part 3 EXECUTION

3.1 WORKMANSHIP

.1 Do terrazzo Work in accordance with CSC Architectural Specification Study on Terrazzo (Portland cement), produced in cooperation with Terrazzo, Tile and Marble Association of Canada (TTMAC), except where specified otherwise.

.2 Apply terrazzo after concrete slabs have cured 28 days.

.3 Install divider strips true and level to detailed pattern.

.4 Produce terrazzo finished surfaces to match existing.

3.2 FLOORS

.1 Monolithic terrazzo: provide 13mm (1/2") minimum terrazzo topping bonded to concrete base slab.

.1 Bonded terrazzo: to TTMAC detail no. 1.

.2 Floating standard terrazzo: to TTMAC detail no. 2.

.3 Venetian terrazzo: to TTMAC detail no. 2V.

.2 Bed: concrete 38mm (1-1/2") minimum.

3.3 SEALING AND GRINDING

.1 Surface and grout terrazzo when it has set sufficiently hard. Surface by machine rubbing with No. 24 grit or finer abrasive blocks. Use plenty of water during grinding. Immediately following initial grinding, flush terrazzo surfaces thoroughly using water only and apply a grout to fill the voids. Mix grouts same proportions as used in topping.

.2 Allow grouted surface to cure for at least 48 hours and then re-surface by machine rubbing using No.120 grit abrasive blocks and plenty of water.

.3 Following removal of grout, scrub terrazzo thoroughly using machine scrubbers and ample clean water. Rinse terrazzo with clean water and then dry thoroughly. Apply a coat of sealer as soon after cleaning as possible.

.4 Apply sealer in accordance with manufacturer’s written instructions. Wipe off excess water before it dries.

.5 Apply second coat of sealer in same manner as first, but not until all other Work is complete and terrazzo has been cleaned again as previously specified above. Apply two (2) coats of surface finish.

.6 Clean, seal and finish terrazzo surfaces to TTMAC recommendations.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-4.129 – Carpet for Commercial Use

.2 CAN/CGSB-25.20 – Surface Sealers for Floors

.2 Carpet and Rug Institute (CRI)

.1 CRI Standard for Installation Specification of Commercial Carpet

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide samples in accordance with Section 01 33 00, Submittal Procedures.

.2 Samples: submit duplicate full size tile of each type, pattern and colour carpet specified.

1.3 CLOSEOUT SUBMITTALS

.1 Maintenance Data: submit maintenance data for incorporation into Operations and Maintenance Manual. Include:

.1 Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.

.2 Precautions for cleaning materials and methods that could be detrimental to carpet.

.3 List of stains and chemicals which may be harmful to the specific fibre.

.2 Extra stock materials:

.1 Field: provide material equal to two percent (2%) of carpet area (minimum three (3) tiles) for maintenance use.

.2 Accent: provide material equal to two percent (2%) of carpet area (minimum three (3) tiles) for maintenance use.

.3 Maintenance materials to be full size piece of same production run as installed materials.

.4 Store where directed by The City.

1.4 QUALITY ASSURANCE

.1 Installer qualifications: a qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor covering installation indicated.

.2 Submit list of successful installations upon request.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Store packaged materials in original containers or wrapping with manufacturer's seals and labels intact.

.2 Store carpet and any adhesives at a temperature between 16°C and 29°C and a relative humidity of maximum 65% for minimum 48 hours prior to installation.

.3 Prevent damage to materials during handling and storage. Keep materials under cover and free from dampness.

.4 Store materials in area of installation for minimum period of 48 hours prior to installation. Carpet tiles must be removed from cartons to adjust to room temperature properly.

1.6 ENVIRONMENTAL CONDITIONS

.1 Comply with CRI Carpet Installation Standard for temperature, humidity, and ventilation limitations.

.2 Do not commence with carpet installation until all painting and finishing Work is complete, and all ceilings and overhead Work is completed, tested, and approved.

.3 Maintain room temperature between 16°C and 29°C for 48-72 hours prior to, during and for 48-72 hours after installation and relative humidity at approximately that at which the area is to be maintained.

.4 Provide sufficient lighting.

1.7 WARRANTY

.1 Contractor hereby warrants that carpeting will provide specified level of appearance, subject to proper care and maintenance, for three (3) years from date of Substantial Completion.

.2 Include a copy of the manufacturer's warranty in the Operating and Maintenance Manuals.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Carpet tile: to CAN/CGSB-4.129.

.1 Field colour, standard of acceptance: MILLIKEN – Revelation Trimline collection, pattern "Pathway", or approved equal.

.2 Accent tile, standard of acceptance: MILLIKEN – Formwork, or approved equal.

.2 Adhesive: release type recommended by carpet manufacturer to suit application and expected service.

.3 Carpet grippers: types as recommended by carpet manufacturer.

.4 Seaming tape: types as recommended by carpet manufacturer for purpose intended.

.5 Concrete floor sealer: to CAN/CGSB-25.20, “Surface Sealer for Floors”, Type 1.

.6 Sub-floor filler: polymer modified cementitious-based floor patch, with acrylic additive. Standard of acceptance: Mapei Plani-Patch and Plani-Patch Plus, or approved equal.

.7 Resilient base: refer to Section 09 65 00 – Resilient Flooring.

.8 Transition strips: refer to Section 09 65 00 – Resilient Flooring.

Part 3 EXECUTION

3.1 PREPARATION OF SURFACES

.1 Clean floors of dust, dirt, solvents, oils, grease, paint, plaster, and all other substances detrimental to the proper performance of adhesive and carpet. Allow to thoroughly dry.

.2 Ensure floors are level, with maximum surface variation of 6mm in 3m (1/4” in 10ft), without ripples or undulations, which could cause premature wearing.

.3 Ensure concrete floors are free from scaling and chatter marks and exhibit neutrality relative to acidity and alkalinity.

3.2 SUBSTRATE

.1 Remove substrate ridges and bumps with power sander.

.2 Fill minor low spots, cracks, joints, holes and other defects with sub-floor filler.

.3 Clean floor and apply filler, trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured.

.4 Prime or seal substrate to flooring manufacturer’s recommendations.

3.3 CARPET TILE INSTALLATION

.1 Comply with CRI Carpet Installation Standard and carpet manufacturer's written installation instructions.

.2 Installation method: glue down, install every tile with full spread, releasable, pressure-sensitive adhesive.

.3 Installation pattern: ashlar random.

.4 Integrate and blend carpet from different cartons to ensure minimal variation in colour match.

.5 Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

.6 Lay carpet tile to pattern as directed by Contract Administrator, tile direction parallel to next unit, set parallel to building lines.

.7 Terminate flooring at centreline of door in openings where adjacent floor finish, colour, or material is dissimilar. Note locations where material thickness changes, flooring material on door swing side shall continue to accommodate door drop sound seals.

3.4 BASE APPLICATION

.1 Refer to Section 09 65 00 – Resilient Flooring.

3.5 CLEANING AND PROTECTION

.1 Perform the following operations immediately after installing carpet:

.1 Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.

.2 Remove yarns that protrude from carpet surface.

.3 Vacuum carpet using commercial machine with face-beater element.

.2 Protect installed carpet to comply with CRI Carpet Installation Standard.

.3 Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer.

END OF SECTION

Part 1 GENERAL

1.1 ACTION AND INFORMATIONALS SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product data: provide data on wall covering and adhesive.

.3 Samples: submit two (2) samples of each type and pattern of wall covering illustrating colour, finish and texture.

.4 Shop Drawings: show location and extent of each wall covering type. Indicate pattern placement if applicable, seams and termination points.

1.2 CLOSEOUT SUBMITTALS

.1 Maintenance data:

.1 Provide maintenance data for vinyl wall coverings including cleaning procedures.

.2 Extra stock materials:

.1 Furnish extra materials that match and are from same production runs as products installed and that are rolled on cardboard cores and packaged with protective covering for storage, identified with labels describing contents.

.1 Wall-covering materials: for each type, full-width units equal to five (5) percent of amount installed.

.2 Store where directed by The City.

1.3 QUALITY ASSURANCE

.1 Installer qualifications: a qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor covering installation indicated.

.1 Submit list of successful installations upon request.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's recommendations.

.2 Inspect roll materials on site to verify acceptance.

.3 Protect packaged adhesive from temperature cycling and cold temperatures.

.4 Do not store roll goods on end.

1.5 ENVIRONMENTAL CONDITIONS

.1 Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or vinyl covering product manufacturer.

.1 Maintain these conditions 24 hours before, during and after installation of adhesive wall covering.

.2 Lighting: do not install wall covering until a permanent level of lighting is provided on the surfaces to receive wall covering.

.3 Ventilation: provide continuous ventilation during installation and for not less than the time recommended by wall covering manufacturer for full drying or curing.

1.6 WARRANTY

.1 Provide warranty against defects in materials and workmanship including lifting, separation from backings or substrate, buckling, wrinkling, and open curling, or stains caused by bleeding of impurities from wall covering.

.1 Warranty period: two (2) years from the date of Substantial Completion.

Part 2 PRODUCTS

2.1 WALL COVERINGS

.1 General: provide rolls of each type of wall covering from same print run or dye lot.

2.2 MATERIALS

.1 Vinyl wall coverings (VWC):

.1 Standard of acceptance: “Restoration Elements” collection, 54” wide, 20 oz./lineal yard, as manufactured by York Contract, and as distributed by LEVEY Wallcoverings, or approved equal.

.2 Approved equals:

.1 “A to Z” collection, as manufactured and distributed by Odyssey Wallcoverings

.2 “Studio Source” collection, as manufactured by York Contract, and as distributed by Metro Wallcoverings.

.2 Adhesive: mildew-resistant, non-staining type as recommended by wall covering manufacturer to suit application to substrate.

.3 Substrate filler: as recommended by adhesive and wall covering manufacturer; compatible with substrate.

.4 Primer/sealer: mildew-resistant, complying with Section 09 91 10 – Painting, and as recommended by wall covering manufacturer for intended substrate.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.

.2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

.1 Comply with manufacturer's written instructions for surface preparation.

.2 Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.

.3 Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.

.1 Moisture content: maximum of five (5) percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.

.2 Plaster: allow new plaster to cure. Neutralize areas of high alkalinity. Prime with primer as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.

.3 Gypsum board: prime with primer as recommended by primer/sealer manufacturer and wall covering manufacturer.

.4 Painted surfaces:

.1 Existing alkyd or oil-based paint: sand lightly, remove dusting.

.2 Existing latex-based paint: apply one coat of alkyd base paint and allow to dry.

.4 Check painted surfaces for pigment bleeding. Sand gloss, semi-gloss, and eggshell finish with fine sandpaper.

.5 Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

.6 Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 INSTALLATION

.1 General: comply with wall covering manufacturers' written installation instructions applicable to products and applications indicated except where more stringent requirements apply.

.2 Cut wall covering strips in roll number sequence. Change roll numbers at partition breaks and corners.

.3 Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage.

.4 Install seams vertical and plumb at least 150mm from inside and outside corners unless a change of pattern or colour exists at corner. No horizontal seams are permitted.

.5 Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

.6 Trim edges and seams for colour uniformity, pattern match, and tight closure. Butt seams without any overlay or spacing between strips.

.7 Hang non-matched patterns by overlapping edges and double cutting through both thicknesses with 1 or 1.5mm thick zinc or aluminum strip back-up to prevent cutting substrate.

3.4 CLEANING

.1 Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.

.2 Use cleaning methods recommended in writing by wall-covering manufacturer.

.3 Replace strips that cannot be cleaned.

.4 Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 Master Painters Institute (MPI)

.1 MPI Architectural Painting Specifications Manual

.2 Department of Justice Canada, Canadian Environmental Protection Act (CEPA)

.3 Environmental Protection Agency (EPA)

.1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for surface coatings)

.4 Health Canada/WHMIS, Material Safety Data Sheets (MSDS)

.5 Society for Protective Coatings (SSPC)

.1 SSPC Painting Manual, Systems and Specifications Manual

1.2 QUALITY ASSURANCE

.1 Contractor shall have a minimum of five (5) years proven satisfactory experience. When requested, provide a list of the last three (3) comparable projects, including job name and location, specifying authority, and project manager.

.2 Qualified journeymen who have a “Tradesman Qualification Certificate of Proficiency” shall be engaged in painting Work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.

.3 Conform to the latest MPI requirements for painting Work, including preparation, priming and workmanship.

1.3 COLOUR SCHEDULE

.1 Provide to the Contract Administrator colour fans (samples) of manufacturer, if requested.

.2 Paint colours will be selected by the Contract Administrator. One (1) copy of the colour schedule will be provided to the General Contractor prior to commencement of painting operations.

.3 Maintain one (1) copy of the colour schedule on site during painting.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver paint materials in sealed original labelled containers bearing manufacturer’s name, type of paint, brand name, colour designations and instructions for mixing and/or reducing.

.2 Remove all damaged, opened and rejected materials from the site.

.3 Observe manufacturer's recommendations for storage and handling.

.4 Comply with requirements of authorities having jurisdiction, in regard to the use, handling, storage and disposal of hazardous materials.

.5 Provide adequate storage facilities. Store paint materials at a minimum ambient temperature of 10°C, and in a well-ventilated area.

.6 Take all precautionary measures to prevent fire hazards and spontaneous combustion.

1.5 MAINTENANCE MATERIALS

.1 Provide one (1) 4L can of each type and colour of finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

.2 Deliver to Contractor and store where directed.

1.6 ENVIRONMENTAL CONDITIONS

.1 Measure moisture content of surfaces using a calibrated electronic 'Moisture Meter', except test concrete floors for moisture using a simple cover patch test. Do not apply finishes unless the moisture content of surfaces are below the maximums:

.1 Gypsum wallboard: 12%

.2 Masonry, concrete and concrete block: 12%)

Note: Concrete and masonry surfaces must be installed minimum 28 days prior to painting and must be visually dry on both sides.

.3 Interior located wood: 15%

.2 Ensure substrate temperature, and the surrounding air temperature, is above 10°C and below 32°C, before applying finishes, unless indicated otherwise by manufacturer.

.3 Perform no painting when the relative humidity is above 85% or when the dew point is less than 3°C below ambient or surface temperature.

.4 Provide adequate continuous ventilation and sufficient heating facilities to maintain ambient and substrates temperature above 10°C, for 24 hours before, during, and after paint application until paint has cured sufficiently (minimum 48 hours).

.5 Provide minimum 30-foot candles of lighting on surfaces to be finished.

.6 Apply paint finish only in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.7 Apply exterior paint finishes only when conditions forecast for entire period of application fall within manufacturer's recommendations.

.8 Provide and maintain cover when exterior paint must be applied in damp or cold weather. Heat substrates and surrounding air to comply with temperature and humidity conditions specified by manufacturer. Protect until paint is dry or until weather conditions are suitable.

1.7 PROTECTION

.1 Adequately protect other surfaces from paint and damages. Make good any damage as a result of inadequate or unsuitable protection.

.2 Furnish sufficient drop cloths, shields and protective equipment to prevent spray of droppings from fouling surfaces not being painted and, in particular, surfaces within storage and preparation area.

.3 Place cotton waste, cloths, and material, which may constitute a fire hazard in closed metal containers and remove daily from site.

.4 Remove all electrical plates, surface hardware, fittings, and fastenings, prior to painting operations. These items are to be carefully stored, cleaned and replaced on completion of Work in each area. Do not use solvent to clean hardware that may remove the permanent lacquer finish.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Paint materials listed in the latest edition of the MPI Approved Products List (APL) are acceptable for use on this project.

.2 Provide paint materials for paint systems from single manufacturer.

.3 All materials used shall be lead and mercury free and shall have low VOC content where possible.

.4 Conform to latest MPI requirements for interior painting work including preparation and priming.

.5 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.

.6 Linseed oil, shellac and turpentine: highest quality product from approved manufacturer listing in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.

.7 Paints to have a good flowing and brushing properties and be capable of drying or curing free of streaks or sags.

2.2 MIXING AND TINTING

.1 Unless otherwise specified herein, all paint shall be ready-mixed and pre-tinted. Re-mix all paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

.2 Paste, powder or catalyzed paint mixers shall be mixed in strict accordance with manufacturer's written instructions.

.3 Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.

.4 If required, thin paint for spraying in strict accordance with manufacturer's instructions.

2.3 GLOSS/SHEEN RATINGS

.1 Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following MPI values:

Gloss Level	Description	Gloss @ 60 degrees	Sheen @ 85 degrees
G1	Matte or Flat finish	0 to 5	10 max.
G2	Velvet finish	0 to 10	10 to 35
G3	Eggshell finish	10 to 25	10 to 35
G4	Satin finish	20 to 35	35 min.
G5	Semi-Gloss finish	35 to 70	
G6	Gloss finish	70 to 85	
G7	High-Gloss finish	> 85	

.2 Gloss level ratings of all painted surfaces shall be as specified herein.

Part 3 EXECUTION

3.1 CONDITIONS OF SURFACES

.1 Thoroughly examine all surfaces scheduled to be painted prior to commencement of Work. Report in writing to the Contract Administrator any condition that may potentially affect proper application. Do not commence until all such defects have been corrected.

.2 Be responsible for the condition of surfaces or for correcting defects and deficiencies in the surfaces, which may adversely affect Work of this Section.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.3 PREPARATION OF SURFACES

.1 Prepare all surfaces in accordance with MPI requirements. Refer to MPI Manual in regard to specific requirements and as follows:

.1 Remove dust, dirt, and other surface debris by wiping with dry, clean cloths.

.2 Wash surfaces with a biodegradable detergent and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly.

.5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.

.2 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pre-treatment as soon as possible after cleaning and before deterioration occurs.

.3 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease, and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes.

.4 Touch up of shop primers with primer as required.

3.4 APPLICATIONS

.1 Apply paint and other finishes in accordance with MPI Painting Manual Premium Grade finish requirements.

.2 Apply paint in a workmanlike manner using skilled and trade qualified applicators.

.3 Apply each coat at the proper consistency.

.4 Each coat of paint is to be slightly darker than the preceding coat, unless otherwise approved by the Contract Administrator.

.5 Unless otherwise approved, apply a minimum of four (4) coats of paint where deep or bright colours are used to achieve satisfactory results.

.6 Sand and dust between each coat to provide an anchor for next coat and to remove defects visible from a distance up to 1000mm (39").

.7 Do not apply finishes on surfaces that are not sufficiently dry. Unless manufacturer's directions state otherwise, each coat shall be sufficiently dry and hard before a following coat is applied.

.8 Paint finish shall continue through behind all wall-mounted items (re: white and tack boards).

.9 Where clear finishes are required, ensure tint fillers match wood. Work fillers well into the grain before it has set. Wipe excess from the surface.

.10 Back prime interior woodwork, which is to receive a paint or enamel finish, with enamel undercoater paint.

.11 Back prime interior woodwork, which is to receive stain and/or varnish finish, with a gloss varnish, reduced by 25% with mineral spirits.

.12 Apply enamel undercoat to all primed and galvanized/zinc coated doors, frames, etc.

.13 Prime top and bottom edges of wood and metal doors with enamel undercoater when they are to be painted.

.14 Paint tops of low partitions (partitions stopping below ceiling height).

.15 Paint metal angles and anchor plates scheduled to be covered by spray-on acoustic treatment, white, to eliminate 'read-thru'.

.16 At locations where demolition has exposed previously unpainted surfaces, provide additional base coats so new finish will blend with adjacent painted surfaces.

3.5 MECHANICAL AND ELECTRICAL EQUIPMENT

.1 Prime and paint exposed insulated and bare pipes, conduits, boxes, insulated and bare ducts, hangers, brackets, collars, and supports, except where items are plated or covered with a prefinished cladding. Paint to colours of adjacent walls, ceilings, etc. to Contract Administrator's direction.

.2 Remove grilles, covers and access panels for mechanical and electrical systems from location and paint separately.

.3 Finish paint primed equipment.

.4 Keep sprinkler heads free of paint.

.5 Replace identification markings on mechanical and electrical equipment when painted over or spattered.

.6 Paint both faces and edges of plywood backboards for electrical equipment before installing backboards and before equipment is mounted on them.

.7 Paint exterior ductwork, conduit, etc. as noted on drawings.

3.6 CLEANING

.1 As the Work proceeds, and upon completion, promptly remove all paint where spilled, splashed, spattered, or sprayed, using means and materials that are not detrimental to affected surfaces.

.2 During the progress of Work, keep premises free from any unnecessary accumulation of tools, equipment, surplus materials and debris.

.3 Remove combustible rubbish materials and empty paint cans each day and safely dispose of same in accordance with requirements of authorities having jurisdiction.

.4 Upon completion of Work, leave premises neat and clean, to the satisfaction of the Contract Administrator.

3.7 ACCENT AND DEEP COLOURS

.1 Refer to finish schedule and interior elevations for accent colour finish. Note that deep tone colours may be required as per the colour schedules.

.2 Use deep tone primers for deep tone colours.

3.8 PREFINISHED ITEMS

.1 This trade should note that casework in Section 06 41 00, Architectural Casework, is all prefinished, where melamine and plastic laminates are used.

3.9 SITE TOLERANCES

.1 Painting surfaces shall be considered unacceptable if any of the following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces:

.1 visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 1000mm (39”)

.2 visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 1000mm (39”)

.3 visible defects are evident on ceiling, soffit or other overhead surfaces when viewed at normal viewing angles

.4 when final coat on any surface exhibits a lack of uniformity of colour, sheen, texture, and hiding across full surface area

3.10 INTERIOR PAINT AND COATING SYSTEMS

.1 Concrete horizontal surfaces (floors):

.1 INT 3.2F

.2 Concrete masonry units:

.1 INT 4.2D-G3

.3 Structural steel (with fireproofing):

.1 Intumescent fireproofing (to Section 07 81 23)

.2 INT 5.1R-G5, compatible with intumescent fireproofing coating

.4 Metal fabrications:

.1 INT 5.1R-G5

.5 Overhead decking, pipes and ductwork:

.1 INT 5.3H

.6 Galvanized metal, galvanized metal doors and frames:

.1 INT 5.3M-G5

.7 Dressed lumber (wood doors, frames, mouldings):

.1 INT 6.3E-G4

.8 Wood paneling and casework:

.1 Clear finish: INT 6.4J

.2 Paint finish: INT 6.4S-G3

.9 Gypsum board:

.1 INT 9.2B-G3

.2 (Epoxy) INT 9.2E

.10 Canvas covered ductwork and piping:

.1 INT 10.1A-G3

3.11 EXTERIOR FINISH/COATING SYSTEMS

.1 Metal fabrications:

.1 EXT 5.1C-G5

.2 (Epoxy) EXT 5.1F

.2 Galvanized metal fabrications:

.1 EXT 5.3B-G5

END OF SECTION

2624 CITY ARCHIVES BUILDING REDEVELOPMENT – ROOM FINISH SCHEDULE

ABBREVIATIONS:

ACT-#	Acoustic Tile
B/H	Bulkhead
C.B.	Concrete Block
CLG	Ceiling
CLN	Clean
CONC	Concrete
CPT	Carpet Tile
E.PNT	Epoxy Paint
EXIST	Existing
GLAZ	Glazed Partition Wall System
GWB	Gypsum Wallboard
IMP	Insulated Metal Panel
MASON	Masonry (brick and/or stone)
MDF	Medium Density Fibreboard
MW.B	Millwork Wall Base
PLAS	Cement Plaster
P+MG	Patch & Make Good
PNT	Paint
POR.T.	Porcelain Tile
R.B.	Rubber Base
RSF	Resilient Sheet Flooring
RUB	Rubber Sheet/Tile Flooring
VWC	Vinyl Wall Covering
WD.B.	Wood Base

GENERAL NOTES:

- All GWB shall be 5/8" (16mm) Type 'X' unless noted otherwise.
- Provide solid wood blocking within studs for anchoring fitments including millwork, trim, white & tack boards.
- GWB bulkheads shall be PNT finish c/w steel stud bracing as required.
- RSF base shall be 4" (102mm) high c/w cap & fillets, unless noted otherwise.
- RSF flooring shall be c/w 1/4" (6mm) G1S plywood underlayment.
- Refer to interior elevations for all accent paint locations.
- All exposed Mechanical and Electrical components are to be painted, unless noted otherwise.
- All exposed ceiling structure and roof decking components are to be painted, unless noted otherwise.
- Where applicable, all existing flooring is to be completely removed prior to installing new flooring material. Patch and make good as required, ensuring level finish for all existing subfloors prior to new flooring installation.
- All new interior partition walls are to extend to u/s of roof decking and / or floor decking above, unless noted otherwise.
- All new or patched walls not shown on interior elevations are to be painted. Refer to plan drawings for extents.
- Existing WD.B shall be removed & reinstalled c/w PNT finish, typical; where indicated, new MW.B, R.B. or RSF self-base shall be installed over reinstalled WD.B.

- ACT-1: 24"x24" c/w suspension grid system, non-rated.
- ACT-2: 24"x48" c/w suspension grid system, non-rated.
- RSF-1: resilient sheet flooring c/w rubber base.
- RSF-2: slip-resistant resilient sheet flooring c/w self-base.

2624 CITY ARCHIVES BUILDING REDEVELOPMENT – ROOM FINISH SCHEDULE										
NUMBER	ROOM NAME	FLOOR			WALLS		CEILING			REMARKS
		MAT'L	FINISH	BASE	MAT'L	FINISH	MAT'L	HEIGHT	FINISH	
BASEMENT LEVEL										
001	RECORD STORAGE	CONC	SEAL	WD.B R.B.	EXIST MASON	P+MG PNT	GWB	±10'-5"	PNT	
002	STORAGE	EXIST CONC	P+MG CLN	WD.B R.B.	EXIST MASON	P+MG PNT	GWB	±10'-5"	PNT	
003	SERVICE	EXIST CONC	P+MG CLN	---	EXIST MASON	P+MG PNT	EXIST CONC	VARIES	---	
004	FOYER	EXIST CONC	P+MG CLN	WD.B R.B.	EXIST MASON	P+MG PNT	GWB	±10'-5"	PNT	
					GWB	PNT				
005	SERVICE	EXIST CONC	P+MG CLN	---	EXIST MASON	P+MG PNT	EXIST CONC	VARIES	---	
006	STORAGE	EXIST CONC	P+MG CLN	WD.B R.B.	EXIST MASON	P+MG PNT	GWB	±10'-5"	PNT	
007	RECORD STORAGE	CONC	SEAL	WD.B R.B.	EXIST MASON	P+MG PNT	GWB	±10'-5"	PNT	
008	RECORD STORAGE	CONC	SEAL	WD.B R.B.	EXIST MASON	P+MG PNT	GWB	±10'-5"	PNT	
009	STAGING	CONC	SEAL	WD.B R.B.	EXIST MASON	P+MG PNT	GWB	±10'-5"	PNT	
010	STAGING	CONC	SEAL	WD.B R.B.	EXIST MASON	P+MG PNT	GWB	±10'-5"	PNT	
011	CORRIDOR	EXIST CONC	P+MG CLN	WD.B R.B.	EXIST MASON	P+MG PNT	GWB	±10'-5"	PNT	
					GWB	PNT	ACT-2	8'-0"	---	

2624 CITY ARCHIVES BUILDING REDEVELOPMENT – ROOM FINISH SCHEDULE										
NUMBER	ROOM NAME	FLOOR			WALLS		CEILING			REMARKS
		MAT'L	FINISH	BASE	MAT'L	FINISH	MAT'L	HEIGHT	FINISH	
012	ELEV MECHANICAL	EXIST CONC	P+MG CLN	---	EXIST MASON	P+MG PNT	GWB	±10'-5"	PNT	
013	JANITOR	EXIST CONC	P+MG CLN	---	EXIST MASON	P+MG PNT	GWB	±10'-5"	PNT	
016	SHIPPING & RECEIVING	CONC	CLN	R.B.	EXIST MASON	P+MG PNT	GWB	±10'-5"	PNT	
					GWB	PNT				
017	CORRIDOR	EXIST CONC	P+MG CLN	WD.B R.B.	EXIST MASON	P+MG PNT	GWB	±10'-5"	PNT	
					GWB	PNT	ACT-2	8'-0"	---	
018	ISOLATION	EXIST CONC	P+MG CLN	R.B.	GWB	PNT	GWB	±10'-5"	PNT	
							ACT-2	8'-0"	---	
019	MECHANICAL	EXIST CONC	P+MG CLN	---	EXIST MASON	P+MG E.PNT	GWB	±10'-5"	E.PNT	
					GWB	E.PNT				
020	MECHANICAL	EXIST CONC	P+MG CLN	---	EXIST MASON	P+MG E.PNT	EXIST GWB	±10'-5"	P+MG E.PNT	
021.1	ARCHIVAL SUPPLIES	EXIST CONC	P+MG CLN	R.B.	EXIST MASON	P+MG PNT	GWB	±10'-5"	PNT	
					GWB	PNT				
021.2	ARCHIVAL SUPPLIES	EXIST CONC	P+MG CLN	R.B.	EXIST MASON	P+MG PNT	GWB	±10'-5"	PNT	
					GWB	PNT				

2624 CITY ARCHIVES BUILDING REDEVELOPMENT – ROOM FINISH SCHEDULE										
NUMBER	ROOM NAME	FLOOR			WALLS		CEILING			REMARKS
		MAT'L	FINISH	BASE	MAT'L	FINISH	MAT'L	HEIGHT	FINISH	
022	CORRIDOR	EXIST CONC	P+MG CLN	WD.B R.B.	EXIST MASON	P+MG PNT	GWB	±10'-5"	PNT	
					GWB	PNT	ACT-2	8'-0"	---	
023	LAN	EXIST CONC	P+MG CLN	R.B.	EXIST MASON	P+MG PNT	GWB	±10'-5"	PNT	
					GWB	PNT				
024	CORRIDOR	EXIST CONC	P+MG CLN	WD.B R.B.	EXIST MASON	P+MG PNT	GWB	±10'-5"	PNT	
025.1	MALE WC	RSF-2	CLN	RSF-2	EXIST MASON	P+MG PNT	GWB	±10'-5"	PNT	
					GWB	PNT	ACT-1	8'-0"	---	
025.2	FEMALE WC	RSF-2	CLN	RSF-2	EXIST MASON	P+MG PNT	GWB	±10'-5"	PNT	
					GWB	PNT	ACT-1	8'-0"	---	
027	SERVICE	EXIST CONC	P+MG CLN	---	EXIST MASON	P+MG E.PNT	GWB	±10'-5"	E.PNT	
					GWB	E.PNT				
MAIN FLOOR LEVEL										
100	MAIN ENTRY VESTIBULE	EXIST TER	P+MG CLN	EXIST MARBLE	EXIST PLAS	P+MG PNT	EXIST PLAS	±17'-4"	P+MG PNT	
101	EXIST FEMALE WC	RSF-2	CLN	WD.B RSF-2	EXIST PLAS	VWC	ACT-1	±9'-4"	---	
					EXIST GWB	VWC				

2624 CITY ARCHIVES BUILDING REDEVELOPMENT – ROOM FINISH SCHEDULE										
NUMBER	ROOM NAME	FLOOR			WALLS		CEILING			REMARKS
		MAT'L	FINISH	BASE	MAT'L	FINISH	MAT'L	HEIGHT	FINISH	
102	EXIST MALE WC	RSF-2	CLN	WD.B RSF-2	EXIST PLAS	VWC	ACT-1	±9'-4"	---	
					EXIST GWB	VWC				
					GWB	VWC				
103	MULTI-PURPOSE	CPT	CLN	WD.B MW.B	EXIST PLAS	P+MG PNT	GWB	±17'-2"	PNT	
					GLAZ	CLN	EXIST PLAS B/H	±14'-6"	P+MG PNT	
104	CLOAK	CPT	CLN	WD.B MW.B	EXIST PLAS	P+MG PNT	GWB	±17'-2"	PNT	
					GLAZ	CLN	EXIST PLAS B/H	±14'-6"	P+MG PNT	
105	RECEPTION	CPT	CLN	WD.B MW.B	EXIST PLAS	P+MG PNT	GWB	±17'-2"	PNT	
					GLAZ	CLN	EXIST PLAS B/H	±14'-6"	P+MG PNT	
106	RESEARCH	CPT	CLN	WD.B MW.B	EXIST PLAS	P+MG PNT	GWB	±17'-2"	PNT	
					GLAZ	CLN	EXIST PLAS B/H	±14'-6"	P+MG PNT	
107	MEETING ROOM	CPT	CLN	WD.B MW.B	EXIST PLAS	P+MG PNT	ACT-1	9'-0"	---	
					GWB	PNT	GWB B/HEAD	±12'-6"	PNT	
					GLAZ	CLN				

2624 CITY ARCHIVES BUILDING REDEVELOPMENT – ROOM FINISH SCHEDULE										
NUMBER	ROOM NAME	FLOOR			WALLS		CEILING			REMARKS
		MAT'L	FINISH	BASE	MAT'L	FINISH	MAT'L	HEIGHT	FINISH	
108	OFFICE	CPT	CLN	WD.B MW.B	EXIST PLAS	P+MG PNT	ACT-1	9'-0"	---	
					GWB	PNT	GWB B/HEAD	±12'-6"	PNT	
					GLAZ	CLN				
109	OFFICE	CPT	CLN	WD.B MW.B	EXIST PLAS	P+MG PNT	ACT-1	9'-0"	---	
					GWB	PNT	GWB B/HEAD	±12'-6"	PNT	
					GLAZ	CLN				
110	OFFICE	CPT	CLN	WD.B MW.B	EXIST PLAS	P+MG PNT	ACT-1	9'-0"	---	
					GWB	PNT	GWB B/HEAD	±12'-6"	PNT	
					GLAZ	CLN				
111	BREAK-OUT	CPT	CLN	WD.B MW.B	EXIST PLAS	P+MG PNT	ACT-1	12'-9"	---	
112	KITCHEN	RSF-1	CLN	WD.B R.B.	EXIST PLAS	P+MG PNT	ACT-1	12'-9"	---	
					GWB	PNT				
113	UNIVERSAL WASHROOM	RSF-2	CLN	RSF-2	EXIST PLAS	P+MG PNT	GWB	9'-0"	PNT	
					GWB	PNT				

2624 CITY ARCHIVES BUILDING REDEVELOPMENT – ROOM FINISH SCHEDULE										
NUMBER	ROOM NAME	FLOOR			WALLS		CEILING			REMARKS
		MAT'L	FINISH	BASE	MAT'L	FINISH	MAT'L	HEIGHT	FINISH	
114	FEMALE WC	RSF-2	CLN	RSF-2	EXIST PLAS	P+MG PNT	GWB	8'-0"	PNT	
					GWB	PNT				
115	VAULT L1	RSF-1	CLN	R.B.	GWB	PNT	GWB	±7'-0" ±7'-10"	PNT	
					IMP	CLN				
116	AIRLOCK L1	RSF-1	CLN	R.B.	EXIST PLAS	P+MG PNT	GWB	±7'-10"	PNT	
					GWB	PNT				
117	RETRIEVAL	CPT	CLN	WD.B MW.B	EXIST PLAS	P+MG PNT	ACT-1	12'-9"	---	
118	CORRIDOR	RSF-1	CLN	WD.B R.B.	EXIST PLAS	P+MG PNT	ACT-2	10'-0"	---	
					GWB	PNT				
119	LIFT MECH ROOM	RSF-1	CLN	R.B.	EXIST PLAS	P+MG PNT	GWB	10'-0"	PNT	
					GWB	PNT				
MAIN FLOOR MEZZANINE										
120	AIRLOCK L2	RSF-1	CLN	WD.B R.B.	EXIST PLAS	P+MG PNT	GWB	±7'-10"	PNT	
					GWB	PNT				

2624 CITY ARCHIVES BUILDING REDEVELOPMENT – ROOM FINISH SCHEDULE										
NUMBER	ROOM NAME	FLOOR			WALLS		CEILING			REMARKS
		MAT'L	FINISH	BASE	MAT'L	FINISH	MAT'L	HEIGHT	FINISH	
121	VAULT L2	RSF-1	CLN	R.B.	IMP	CLN	GWB	±7'-0" ±8'-4"	PNT	
SECOND FLOOR LEVEL										
201	STAFF	CPT	CLN	WD.B MW.B	EXIST PLAS	P+MG PNT	EXIST PLAS B/H	±14'-8"	P+MG PNT	
					GLAZ	---	GWB	±19'-2"	PNT	
202	ARCHIVAL WORKSPACE	CPT	CLN	WD.B MW.B	EXIST PLAS	P+MG PNT	EXIST PLAS B/H	±14'-8"	P+MG PNT	
					GLAZ	---	GWB	±19'-2"	PNT	
203	DIGITIZATION	RSF-1	CLN	WD.B MW.B	EXIST PLAS	P+MG PNT	ACT-1	±11'-6"	---	
204	AIRLOCK L3	RSF-1	CLN	R.B.	EXIST PLAS	P+MG PNT	GWB	±7'-5"	PNT	
					GWB	PNT				
205	CONSERVATION	RSF-1	CLN	WD.B MW.B	EXIST PLAS	P+MG PNT	ACT-1	11'-6"	---	
					GWB	PNT				
206	VAULT L3	RSF-1	CLN	R.B.	IMP	CLN	GWB	±6'-10" ±7'-5"	PNT	
207	STAFF LOUNGE	CPT	CLN	WD.B MW.B	EXIST PLAS	P+MG PNT	ACT-1	11'-6"	---	
208	KITCHEN	RSF-1	CLN	WD.B R.B.	EXIST PLAS	P+MG PNT	ACT-1	11'-6"	---	
					GWB	PNT				

2624 CITY ARCHIVES BUILDING REDEVELOPMENT – ROOM FINISH SCHEDULE										
NUMBER	ROOM NAME	FLOOR			WALLS		CEILING			REMARKS
		MAT'L	FINISH	BASE	MAT'L	FINISH	MAT'L	HEIGHT	FINISH	
209	CORRIDOR	RSF-1	CLN	WD.B R.B.	EXIST PLAS	P+MG PNT	ACT-1	11'-6"	---	
					GWB	PNT				
210	FEMALE WC	RSF-2	CLN	RSF-2	EXIST PLAS	P+MG PNT	GWB	8'-0"	PNT	
					GWB	PNT				
211	UNIVERSAL WASHROOM	RSF-2	CLN	RSF-2	EXIST PLAS	P+MG PNT	GWB	11'-6"	PNT	
					GWB	PNT				
212	OFFICE	CPT	CLN	WD.B MW.B	EXIST PLAS	P+MG PNT	ACT-1	9'-0"	---	
					GWB	PNT	GWB B/HEAD	±11'-6"	PNT	
					GLAZ	CLN				
213	OFFICE	CPT	CLN	WD.B MW.B	EXIST PLAS	P+MG PNT	ACT-1	9'-0"	---	
					GWB	PNT	GWB B/HEAD	±11'-6"	PNT	
					GLAZ	CLN				
214	OFFICE	CPT	CLN	WD.B MW.B	EXIST PLAS	P+MG PNT	ACT-1	9'-0"	---	
					GWB	PNT	GWB B/HEAD	±11'-6"	PNT	
					GLAZ	CLN				

2624 CITY ARCHIVES BUILDING REDEVELOPMENT – ROOM FINISH SCHEDULE										
NUMBER	ROOM NAME	FLOOR			WALLS		CEILING			REMARKS
		MAT'L	FINISH	BASE	MAT'L	FINISH	MAT'L	HEIGHT	FINISH	
215	OFFICE	CPT	CLN	WD.B MW.B	EXIST PLAS	P+MG PNT	ACT-1	9'-0"	---	
					GWB	PNT	GWB B/HEAD	±11'-6"	PNT	
					GLAZ	CLN				
216	OFFICE	CPT	CLN	WD.B MW.B	EXIST PLAS	P+MG PNT	ACT-1	9'-0"	---	
					GWB	PNT	GWB B/HEAD	±11'-6"	PNT	
					GLAZ	CLN				
217	MEETING	CPT	CLN	WD.B MW.B	EXIST PLAS	P+MG PNT	ACT-1	9'-0"	---	
					GWB	PNT	GWB B/HEAD	±11'-6"	PNT	
					GLAZ	CLN				
218	OFFICE	CPT	CLN	WD.B MW.B	EXIST PLAS	P+MG PNT	ACT-1	9'-0"	---	
					GWB	PNT	GWB B/HEAD	±11'-6"	PNT	
					GLAZ	CLN				
219	OFFICE	CPT	CLN	WD.B MW.B	EXIST PLAS	P+MG PNT	ACT-1	9'-0"	---	
					GWB	PNT	GWB B/HEAD	±11'-6"	PNT	
					GLAZ	CLN				

2624 CITY ARCHIVES BUILDING REDEVELOPMENT – ROOM FINISH SCHEDULE										
NUMBER	ROOM NAME	FLOOR			WALLS		CEILING			REMARKS
		MAT'L	FINISH	BASE	MAT'L	FINISH	MAT'L	HEIGHT	FINISH	
220	OFFICE	CPT	CLN	WD.B MW.B	EXIST PLAS	P+MG PNT	ACT-1	9'-0"	---	
					GWB	PNT	GWB B/HEAD	±11'-6"	PNT	
					GLAZ	CLN				
SECOND FLOOR MEZZANINE										
221	AIRLOCK L4	RSF-1	CLN	R.B.	EXIST PLAS	P+MG PNT	GWB	±9'-0"	PNT	
					GWB	PNT				
222	VAULT L4	RSF-1	CLN	R.B.	IMP	CLN	GWB	±7'-3" ±9'-0"	PNT	
STAIRS & ELEVATORS										
E01	EXIST ELEVATOR									
E02	MATERIALS LIFT	CONC	CLN	---	EXIST MASON	P+MG PNT	GWB	±17'-2"	PNT	
					CONC	---				
					GWB	PNT				
S01	EXIST MAIN ENTRY	EXIST TER	P+MG CLN	EXIST MARBLE	EXIST MARBLE	CLN	EXIST PLAS	VARIES	P+MG PNT	
					EXIST PLAS	P+MG PNT				

2624 CITY ARCHIVES BUILDING REDEVELOPMENT – ROOM FINISH SCHEDULE										
NUMBER	ROOM NAME	FLOOR			WALLS		CEILING			REMARKS
		MAT'L	FINISH	BASE	MAT'L	FINISH	MAT'L	HEIGHT	FINISH	
S02	EXIT STAIR	RSF-1	CLN	R.B.	EXIST PLAS	P+MG PNT	GWB	VARIES	PNT	
		RUB	CLN	R.B.	GWB	PNT				
S03	EXIST EXIT STAIR	RUB	CLN	R.B.	EXIST PLAS	P+MG PNT	EXIST PLAS	VARIES	P+MG PNT	
					GWB	PNT				
S04	ACCESS STAIR	RSF-1	CLN	WD.B R.B.	EXIST PLAS	P+MG PNT	GWB	±7'-10"	PNT	
		RUB	CLN	R.B.	GWB	PNT				

Part 1 GENERAL

1.1 REFERENCES

.1 American Architectural Manufacturer's Association (AAMA)

.1 AAMA 611 – Voluntary Specification for Anodized Architectural Aluminum

.2 American Society for Testing and Materials (ASTM)

.1 ASTM B221/ASTM B221M – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

.2 ASTM C920 – Standard Specification for Elastomeric Joint Sealants

.3 ASTM C1036 – Standard Specification for Flat Glass

.4 ASTM C1048 – Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product data: manufacturer's descriptive literature for each component in partition assembly.

.3 Shop Drawings: Provide drawings showing layout, dimensions, identification of components, and interface with adjacent construction.

.1 Include field measurements of openings.

.2 Include elevations showing:

.1 Locations and identification of manufacturer-supplied door hardware and fittings.

.2 Locations and sizes of cut-outs and drilled holes for other door hardware.

.3 Include details showing:

.1 Requirements for support and bracing of overhead track.

.2 Installation details.

.3 Appearance of manufacturer-supplied door hardware and fittings.

.4 Selection samples: two (2) sets, representing manufacturer's full range of available metal materials and finishes.

.5 Verification samples: two (2) samples, minimum size 50mm by 75mm (2" x 3"), representing actual material and finish of exposed metal.

.6 Design data: design calculations, bearing seal and signature of structural engineer licensed to practice in the Province of Manitoba, showing loads at points of attachment to the building structure.

1.3 CLOSEOUT SUBMITTALS

.1 Provide data for maintenance of doors for incorporation into maintenance manual.

1.4 QUALITY ASSURANCE

.1 Fabricator qualifications: minimum three (3) years of experience designing, assembling, and installing partition assemblies similar to those specified in this section.

.2 Single source responsibility: provide glazed interior wall and door assemblies from a single source to ensure uniformity in quality of appearance, finish and construction.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Store products in manufacturer's unopened packaging until ready for installation.

Part 2 PRODUCTS

2.1 MANUFACTURER

.1 Standard of acceptance: DIRTT Glass Partition Walls, or approved equal.

2.2 FRAMELESS GLAZED INTERIOR WALL AND DOOR ASSEMBLIES

.1 Frameless glazed interior wall assembly: factory fabricated assemblies consisting of full-width and height glass panels fastened with low profile sidelite aluminum rail fittings on top and bottom edge of glass wall.

.1 Configuration: as indicated on drawings.

.2 Full length top and bottom sidelite rails: 59mm (2-5/16") high by 38mm (1-1/2") deep with end caps.

.3 Sidelight fittings, clad finish: satin anodized.

.4 Glass thickness: 10mm (3/8"), tempered, clear.

.5 Designed to withstand normal operation without damage, racking, sagging, or deflection.

.6 Coordinate wall and door assembly preparation and provide hardware as necessary for fully operable installation.

.7 Finished metal surfaces protected with strippable film.

.8 Factory assembled to greatest extent practical; may be disassembled to accommodate shipping constraints.

.2 Pivoting glass doors: full length dry glazed rail fittings.

.1 Door configuration: as indicated on drawings.

.2 Full length top and bottom rails: 59mm (2-5/16”) high by 38mm (1-1/2”) deep with end caps.

.3 Glass thickness: 10mm (3/8”), tempered.

.4 Sidelight rails: match door rail sightlines and finish.

.5 Aluminum finish: satin anodized.

.6 Door hardware: locking ladder pulls, brushed stainless steel.

.7 Provide accessories as required for complete installation.

2.3 MATERIALS

.1 Glass: flat glass meeting requirements of ASTM C1036, Type I - Transparent Flat Glass, fully tempered in accordance with ASTM C1048, Kind FT, and as follows:

.1 Thickness: as indicated.

.2 Colour: clear.

.3 Prepare glazing panels for indicated fittings and hardware before tempering.

.4 Polish edges that will be exposed in finished work to bright flat polish.

.5 Temper glass materials horizontally; visible tong marks or tong mark distortions are not permitted.

.2 Aluminum components: conforming to ASTM B221 (ASTM B221M), Alloy 6063, T5 Temper.

.3 Sealant: one-part silicone sealant, conforming to ASTM C920, clear.

2.4 FINISHES

.1 All exposed aluminum components shall have black powdercoat paint finish.

2.5 ADDITIONAL DOOR HARDWARE

.1 Refer to Section 08 71 00 – Finish Hardware.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verify that field measurements are as indicated.

.2 Verify that track supports are properly braced, level within 6mm (1/4”) of required position and parallel to the floor surface.

.3 Verify floor flatness of 3mm in 3m (1/8” in 10 feet), non-cumulative.

.4 Do not begin installation until supports and adjacent substrates have been properly prepared.

.5 If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

.1 Clean substrates thoroughly prior to installation.

.2 Prepare substrates using the methods recommended by the manufacturer for achieving acceptable result for the substrate under the project conditions.

3.3 INSTALLATION

.1 Install in accordance with glazed interior wall and door assembly manufacturer's instructions.

.2 Fit and align glazed interior wall and door assembly level and plumb.

3.4 ADJUSTING AND CLEANING

.1 Adjust hardware for proper door function and latching, and for smooth operation without excessive force or excessive clearance.

.2 Touch-up, repair or replace damaged products as required prior to Substantial Completion of the Work.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society of Testing and Materials (ASTM)

.1 ASTM D790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

.2 ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials

.2 National Electrical Manufacturers Association (NEMA)

.3 Underwriters' Laboratories of Canada (ULC)

.1 ULC 102 – Method of Test for Surface Burning Characteristics of Building Materials

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide in accordance with Section 01 33 00 – Submittal Procedures.

.2 Shop drawings: submit shop drawings of panels which show sections, details, joint treatment, accessories and the relation of the panels to adjoining components.

.3 Samples: provide samples of each colour and texture.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Hygienic wall panels and accessories shall be handled and transported in a manner so as not to create damage or excessive stresses.

.2 Store wall panels to protect from staining, contact with soil and from physical damage. The panels shall not be stacked or leaned unless instructed otherwise by the manufacturer.

.3 Store panels flat and precondition for a minimum of 24 hours in the area they will be installed.

1.4 ENVIRONMENTAL CONDITIONS

.1 Wall panels shall be installed at approximately the same ambient service temperature at which the room area will be when commissioned.

1.5 MAINTENANCE DATA

.1 Provide maintenance data on cleaning of wall panel surfaces for inclusion in the Operation and Maintenance manuals.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Manufacturer: Acrovyn Wall Panels, or approved equal.

.1 Colour and Finish: as selected by Contract Administrator from manufacturer's solid colours and neutrals.

.2 Thickness: 9.5mm (3/8") thick particleboard core with 1.02mm (0.040") surface finish.

.2 Approved equal: Panolam Industries, FRL WALL Protection Panels.

.1 Thickness: 0.075 inches nominal.

.2 Colour and Finish: as selected by Contract Administrator from manufacturer's full range of Nevamar or Pionite colours and designs.

.3 Panels shall comply with the following:

.1 Surface burning characteristics: ASTM E 84 Class A; ULC 102 Class A.

.2 Chemical resistant compliant with SEFA 8 requirements.

.3 Wear resistance (Cycles) NEMA 3.13: 3500 typical.

.4 Flexural strength (ASTM D790): 20,148 psi typical.

.5 Moulding profiles: outside corners flat, outside corners round, division bars, inside corners, standard end caps.

.6 Adhesive: as recommended by panel manufacturer.

.7 Joint caulking: as recommended by panel manufacturer.

Part 3 EXECUTION

3.1 PREPARATION OF SUBSTRATE

.1 Prepare in accordance with manufacturer's recommendations.

3.2 INSTALLATION

.1 Install in strict accordance with manufacturer's instructions.

3.3 CLEANING

.1 Clean panel face to remove soiling, stains, dust, and dirt using clean rags, and cleaning agents as instructed by manufacturer.

.2 Leave installation clean, free of residue and debris resulting from work of this section.

END OF SECTION

Part 1 General

1.1 SYSTEM DESCRIPTION

.1 Mechanically assisted, carriage mounted high-density mobile storage units, support rails, shelving, fabrication and installation including leveling of support rails.

.2 Four-post shelving units.

1.2 SYSTEM DESCRIPTION

.1 General: system consists of manufactured storage units mounted on manufacturer's track-guided carriages to form compact storage system. System design permits access to any single aisle by moving nits until desired aisle is opened. Carriage/rail system provides uniform carriage movement along total length of travel, even with unbalanced loads.

.2 Carriage system design and features: carriage system consists of formed welded structural steel frame with machined and balanced wheels riding on steel rails mounted on floor. Rails shall be types selected by manufacturer to ensure smooth operation and self-centering of mobile storage units during travel without end play or binding. Rail types, quantities and spacing shall be selected by manufacturer to suit installation conditions and requirements. All bearings used in drive mechanism shall be permanently shielded and lubricated.

.3 Movement controls: triple operating wheels with rotating hand knobs shall be provided on the accessible (drive) ends of shelf units, centered on end panel, located approximately 1051mm (40") from base of each unit to permit units to be moved to create a single aisle opening. Turning the handle transmits power through chain drive to drive wheels on each carriage.

.4 Drive system: system shall be designed with positive type of mechanically assisted drive which minimizes end play, ensures there is no play in drive handle, and that carriages will stop without drifting.

.1 System shall include a chain sprocket drive system for each movable carrier to ensure that carriages move uniformly along the total length of travel, even with unbalanced loads. All system components shall be selected to ensure smooth, even movement along entire carriage length. Drive system gearing shall be designed to permit 1 lb. of force applied to drive handle to move a minimum of 4,000 lbs. of load.

.2 An automatic tensioning device shall be provided on each chain drive with provision for adjusting tension without removing end panels.

.3 All bearings used in the drive mechanism shall be permanently shielded and lubricated.

.5 Safety features:

.1 Colour-coded visual indicators shall provide verification that carriages are in locked or unlocked mode.

.2 A single safety lock button, mounted on each operating wheel hub, will permit moving a carriage in either direction to create a new access aisle when pulled out (unlocked), or locking the carriage when pushed in.

.3 Anti-tipping devices are required on all carriages.

.4 Internal aisle brakes to be included on all new carriages. 3lbs. or less pressure to be applied to aisle brakes required to fully stop the carriages. Actuator to be full length of carriage to be able to stop the carriage anywhere within the open aisle. Internal aisle brakes to be fully mechanical with no power requirements.

.6 Finishes:

.1 Fabricated mental components and assemblies: manufacturer's standard powder coat paint finish. Colour to be selected by Contract Administrator.

.2 End panels, accessible ends – steel or laminate as selected by Contract Administrator.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product data: submit manufacturer's product literature and installation instructions for each type of shelving, track and installation accessory required. Include data substantiating that products to be furnished comply with requirements of the contract documents.

.3 Shop Drawings:

.1 Show fabrication, assembly, and installation details including descriptions of procedures and diagrams. Show complete extent of installation layout including clearances, spacings, and relation to adjacent construction in plan, elevation and sections. Indicate clear exit and access aisle widths; access to concealed components; assemblies, connections, attachments, reinforcement, and anchorage; and deck details, edge conditions and extent of finish flooring within area where units are to be installed.

.1 Show installation details at non-standard conditions. Furnish track layouts, technical installation manuals for every unit shipment with necessary dimensions for rail layout and system configuration at the project site. Include installed weight, load criteria, furnished specialties, and accessories.

.2 Provide layout, dimensions, and identification of each unit corresponding to sequence of installation and erection procedures. Specifically include the following:

.1 Location, position, and configuration of tracks on all floors.

.2 Plan layouts of positions of carriages, including all required clearances.

.3 Details of shelving, indicating method of configuration of installation in carriages.

.4 Lead time of product for production.

.3 Provide installation schedule and complete erection procedures to ensure proper installation.

.4 Samples:

.1 Submit minimum 50mm (2”) round samples of each colour and texture on actual substrate for each component to remain exposed after installation.

1.4 CLOSEOUT SUBMITTALS

.1 Provide in accordance with Section 01 78 00 – Closeout Submittals.

.2 Maintenance data:

.1 Provide in form suitable for inclusion in maintenance manuals for metal storage shelving. Data shall include operating and maintenance instructions, parts inventory listing, purchase source listing, emergency instructions, and related information.

.1 Submit manufacturer's instructions for proper maintenance materials and procedures.

.2 Submit manufacturer's printed instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use conditions. Include precautions against using materials and methods which may be detrimental to finishes and performance.

1.5 QUALITY ASSURANCE

.1 Source limitations: obtain mobile storage systems including shelving from a single manufacturer.

.2 Installer qualifications: engage an experienced installer who is manufacturer's authorized representative for specified products for installing carriages and anchoring shelving units to carriages.

.1 Minimum qualifications: five (5) years’ experience installing systems of comparable size and complexity to specified project requirements.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer’s name and address.

.2 Store materials in accordance with manufacturer’s recommendations in clean, dry, well-ventilated area.

1.7 PROJECT CONDITIONS

.1 Field measurements: verify dimensions and quantities before fabrication. Indicate verified measurements on Shop Drawings. Coordinate fabrication and delivery to ensure no delay in progress of the Work.

.2 Established dimensions: where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal shelving units. Coordinate construction to ensure actual dimensions correspond to established dimensions.

1.8 SEQUENCING AND SCHEDULING

.1 Schedule installation of metal shelving system after finishing operations, including painting, have been completed.

1.9 WARRANTY

.1 Provide copy of manufacturer's standard warranties for high-density mobile storage shelving system.

Part 2 Products

2.1 MANUFACTURER

.1 Standard of acceptance: products are based upon mobile shelving system products manufactured by Spacefile International Corp, or approved equal.

2.2 MANUFACTURED COMPONENTS

.1 Rails:

.1 Demountable rails with steel deck:

.1 Material: ASTM/AISI Type 1035 or 1045 steel, manufacturer's selection.

.2 Tracks shall be designed and manufactured to carry a minimum load of 1000 pounds per linear foot of carriages. Track rails are 1" hexagonal cold rolled bard stock, supported by 10 gauge formed steel channels.

.3 Tracks shall exhibit no excessive movement or deflection during the normal operation of the system.

.4 Track rails shall be connected to each other by pins to provide horizontal and vertical continuity between the rail sections, and to gradually transfer wheel loads. Tracks shall be connected to each other with 12 gauge cross-channels.

.5 The rail design shall incorporate smooth contact surfaces for the wheels and the wheel guidance system.

.6 Track rails shall be level with and not project above or below the walking surface, flush with floor.

.7 The maximum gap between the rail and the track surfaces (to accommodate the carriage guidance system or the anti-tip mechanism) shall be 5/8" wide.

.8 Tracks must be provided with 12 gauge structural cross members to align adjacent tracks, spaced between each length of track not more than 96" apart.

.9 Tracks shall be designed such that attachment to the floor is not required. Future removal or rearrangement of all or part of the system can be done without damage to the flooring. No grout or permanent attachments to the floor are permitted.

.10 The system shall be leveled using leveling screws attached to the tracks, one pair on each side of the track rails, spaced not more than 7" apart and no more than 1 ½" from each track section end. Leveling screws shall permit up to 1" adjustment to accommodate uneven floors.

.11 The system shall be able to be re-leveled without disassembly or removal of any of the carriages.

.12 Positive carriage stops must be provided at each end of the tracks.

.13 Track to provide channel for anti-tipping device at EVERY track location. An equal number of anti-tip brackets as tracks per carriage to be provided.

.2 Deck/ramp – steel deck:

.1 The entire floor area (deck) that is accessible to the operator shall be provided with a finished steel flooring system. The flooring consists of 14- gauge formed steel sections, each 6" wide and 1" deep, finished with durable non-slip textured powder paint.

.2 Decks shall be designed such that the sections are secure during normal use and operation but can be assembled or disassembled without the use of any tools.

.3 Decks must be easily removed for accessibility to all track parts, and for cleaning and ease of maintenance.

.4 Ramps shall be formed from 14 gauge steel and finished in slip-resistant powder paint to match the decking. Ramps shall have a 1:12 slope aspect ratio.

.2 Carriages:

.1 Mechanical assist:

.1 The carriage system consists of a formed welded structural steel frame with machined and balanced wheels riding on steel rails surface mounted to the floor. Rails shall be types selected by the manufacturer to ensure smooth operation and self-centering of mobile storage units during travel without end play or binding. Rail types, quantities and spacing shall be selected by the manufacturer

to suit installation conditions and requirements. All bearings used in the drive mechanism shall be permanently shielded and lubricated.

.2 Provide stationary carriages of the same construction and height as the movable carriages, anchored to rails. setting fixed shelving directly on floors is not permitted.

.3 When required, provide bolted carriage splices designed to maintain proper unit alignment and weight load distribution.

.2 Drive/guide system:

.1 Design: Provide a driving system which prevents carriage whipping, binding, and excessive wheel/rail wear under normal operation.

.2 Shafts: Solid steel rod.

.3 Shaft Connections: Secured couplings. Simple bolted shaft connections are not acceptable.

.4 Bearing Surfaces: Provide rotating load bearing members with ball or roller bearings. Provide flanged self-aligning type bearings.

.3 Wheels:

.1 Capacity: Minimum load capacity per wheel: 3200 lbs. (1455kg).

.2 Size: Minimum 5.0 inches, outside diameter drive wheels.

.3 Guides: Every wheel/track shall be a drive wheel/track.

.4 Movement Controls - Mechanical: Triple operating wheels with rotating hand knobs shall be provided on the accessible (drive) ends of shelf units, centered on the end panel, located 40 approximately inches (1051MM) from the base of each unit to permit units to be moved to create a single aisle opening. Turning the handle transmits power through chain drive to drive wheels on each carriage.

.5 Drive System: The system shall be designed with a positive type mechanically assisted drive which minimizes end play, ensures there is no play in the drive handle, and that carriages will stop without drifting.

.6 The system shall include a chain sprocket drive system for each movable carriage to ensure that carriages move uniformly along the total length of travel, even with unbalanced loads. All system components shall be selected to ensure smooth, even movement along the entire carriage length. Drive system gearing shall be designed to permit 1 lb. of force applied to the drive handle to move a minimum of 4,000 lbs. of load.

.7 An automatic tensioning device shall be provided on each chain drive with provision for adjusting tension without removing end panels.

.8 All bearings used in the drive mechanism shall be permanently shielded and lubricated.

.4 Safety Features:

.1 Colour-coded visual indicators shall provide verification that carriages are in a locked or unlocked mode.

.2 Single safety lock button, mounted on each operating wheel hub, will permit moving a carriage in either direction to create a new access aisle when pulled out (unlocked), or locking the carriage when pushed in.

.5 Optional add-on safety feature:

.1 Internal aisle brakes are to be included on all new carriages. 3 lbs. or less pressure to be applied to aisle brakes required to fully stop the carriages. Actuator to be the full length of the carriage so as to be able to stop the carriage anywhere within the open aisle. internal aisle brakes to be fully mechanical with no power requirements.

.6 Finishes:

.1 Fabricated Metal Components and Assemblies: manufacturer's standard powder coat paint finish. Colour to be selected by Contract Administrator.

.2 End Panels shall be full height of either ¾" think Laminate or 20-gauge Steel end panels as selected by Contract Administrator.

.3 Shelving:

.1 Shelving equivalent to Spacefile LT Shelving.

.1 Design: Wedge-lock type consisting of uprights, shelves, and shelf supports, designed to be assembled without fasteners or clips except for center stops (if required). Shelves are to be metal (no particle board or melamine boards are acceptable. Shelves shall be solid with no slots except where dividers are being used. Front and back flanges shall be flush with outside faces of posts. Design shall permit individual shelf adjustment and/or removal anywhere along the entire height of uprights.

.2 Materials and Workmanship: Fabricate units from Class 1, cold-rolled steel sheet with all bends sharp and true and no exposed "knife" edges.

.3 All units shall be free of burrs, sharp edges and projecting hardware with smooth, non-abrasive surfaces and edges.

.4 After fabrication, shelving shall exhibit no dents, "oil canning", buckling or other surface irregularities.

.5 Uprights: Formed from 18-gauge steel sheet to a hollow "T" shape for intermediate supports and formed angles for end supports. Uprights shall have keyhole slots on inner wall only. Provide sheet steel panels full height and depth of end uprights. Provide intermediate "tee" uprights between adjacent units. 2.2.3.6. Shelves: Form from sheet steel with flanges on all sides and a return hem on the front and back flanges. Ends shall be formed to clear the

inside of upright offset panels. Shelves shall be independently adjustable. Provide all shelves with slots for file dividers. Shelves shall be 22-gauge, or 18-gauge for heavier duty service. Perforated shelves shall be 22-gauge with holes covering 50% of the surface and will require double the number of shelf reinforcements per shelf.

.6 Canopy Tops: Same construction as shelf units without slots. Canopy Tops shall be 22-gauge.

.7 Shelf Supports: Form from 12-gauge steel sheet with four solid steel shoulder rivets, two per ear, that interlock with inner wall of uprights. (Double Rivet Supports)

.8 Shelf Reinforcements: Form from 14-gauge sheet steel. Quantity of shelf reinforcements as indicated on the drawings.

.9 Nominal shelf dimensions:

.1 Standard Width: 36 inches (914mm), with 30, 42, or 48-inch (762, 1067, or 1219mm) sections used to meet project requirements.

.2 Vertical Minimum Adjustment Increment: 1-1/2 inches (38mm).

.10 Levelness of Completed Shelf Units: Maximum 1/8 inch (3.2MM) between bottom shelf and canopy top, measured along the edge of any upright in any direction.

.11 Number of Vertical Shelf Spaces: As indicated on the drawings.

.12 Vertical Shelf-To-Shelf Spacing: As indicated on the drawings.

.13 Load Carrying Capabilities: Provide shelf units capable of supporting 40 pounds per lineal foot (18kg/305MM) with maximum deflection of L/140. Shelves shall exhibit no permanent deflection under fully loaded conditions.

.14 Accessories: File dividers. As indicated on the drawings.

.15 Reference Shelves As indicated on the drawings.

Part 3 Execution

3.1 EXAMINATION

.1 Examine floor surfaces with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of mobile storage units.

.2 Verify that building structural system is adequate for installing mobile storage units at locations indicated on approved shop drawings.

.3 For installations on existing floors, ensure that rail spacings indicated on shop drawings are in proper locations so existing load-bearing structural members are not over stressed.

.4 Verify that intended installation locations of mobile storage units will not interfere with nor block established required exit paths or similar means of egress once units are installed.

.5 Prepare written report, endorsed by Installer, listing conditions detrimental to proper performance of mobile storage units, once installed.

.6 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

.1 Assemble and install storage shelving in accordance with manufacturer's written instructions.

.2 Rails:

.1 Position Universal Demountable Tracks on the floor. Check the track drawing for spacing details. As an example, on the layout shown on Step 1, Tracks are 13" away from the wall. In this space Rear Decks will be installed. When distance between walls and tracks doesn't give enough room for installing Ramp Screws ¼"-20 x ½" for attaching Rear Deck, install them in advance. 2.2.4.8. Position the Cross Channels, Cross Ends, and Corner Ends (you need four Corner Ends in total) on the floor. Check track drawing for spacing details. (I.e. from walls)

.2 Position the Universal Demountable Track on the top of Cross Channels and align it at 90° to the Cross Channels. Use the leveling bolts as guide and attach the Track to Cross Channel with Thread-Cutting Screw (¼"-20 x ¾"). Ensure the tracks are square by measuring the diagonals, before tightening the screws.

.3 Use Deck Support if the Cross Channels are longer than 42". Use Thread-Cutting Screw ¼"-20 x ¾" to attach Deck Support to Cross Channels. Ensure the tracks are square by measuring the diagonals, before tightening the screws.

.4 Level the track assembly. This is done by either laser level or pair of spirit levels. It is a good idea to survey the floor first to find the low and high points on the floor and place shims where required. The leveling bolts have 1" travel. Levelers should be extended out the minimum distance needed to level the track.

.5 End Cover will be two pieces if the Cross Channels are longer than 42". Use Thread-Cutting Screws ¼"-20 x ¾" to install.

.3 Decks/ramps:

.1 Install Deck Panels. Note: Some installers like to install the Deck Panel, Rear Deck and Ramps before the Carriages are assembled to provide a working surface as well as for ease of installation. However, if you install the Deck Panels Ramps first, you will need to spend time cleaning the system when you are done. It's important that the system be left totally clean before handed over to the end-user.

.2 The Deck Panels must be installed so there is no deflection or “see-sawing”. Raise or lower leveling screws on Deck Support to ensure proper installation.

.3 Tighten Ramp Screws ¼”-20 x ½” to Track Channels that located close to wall then mount the Rear Decks on the screws on the side of the Track Channels. Note that Rear Decks must be level with the decking when system is against the wall. Use leveling bolts attached to Rear Decking for adjusting height of Rear Decking.

.4 Steel Ramps can be placed easily onto the Track Channels and can be removed when required for easy maintenance. First install Ramp Screws ¼”-20 x ½” to Track Channels then mount the Ramps. The screws are attached to the side of the Track Channels. Ramps can be bent to accommodate uneven floors.

.5 For Systems with Adjustable Stationary Bases, follow these steps: Place the Stationary Base on the End Cover. The Stationary Base may be lined up with tracks and can be moved forward and backward if required. If the Stationary Base is line up with the Tracks, Install the Stationary Base to Tracks using one #10 x ¾” drilling screw for each track on corner. Otherwise install the Stationary Base to the End Covers by using one #10 x ¾” drilling screw for each End Cover on corner. Finally, use Leveling Bolts on the Stationary Base to level it.

.6 Finally, install the Plugs in all the visible holes on the track and decking. Place Large (D: ⅝”) and Small (D: ½”) plugs to corresponding holes sizes on system.

.7 Note: If the system is installed on a soft carpet, you should wait to install the plugs until the system is loaded and used for a month. The systems may need to be re-levelled to ensure proper operation. It’s easier to re-level if you don’t have to remove the plugs.

.4 Shelving system:

.1 General: Follow layout and details shown on approved shop drawings and manufacturer's printed installation instructions. Position units level plumb; at proper location relative to adjoining units and related work.

.5 Carriages:

.1 Place movable carriages on rails. Ensure that all wheel’s track properly, and centering wheels are properly seated on centering rails. Fasten multiple carriage units together to form a single movable base where required.

.2 Position fixed carriage units to align with movable units.

.6 Shelving units:

.1 Permanently fasten shelving units to fixed and movable carriages with vibration-proof fasteners.

.2 Stabilize shelving units following manufacturer's written instructions. Reinforce shelving units to withstand the stress of movement where required and specified.

3.3 FIELD QUALITY CONTROL

.1 Verify shelving unit alignment and plumb after installation. Correct if required following manufacturer’s instructions.

.2 Remove components which are chipped, scratched, or otherwise damaged and which do not match adjoining work. Replace with new matching units, installed as specified and in manner to eliminate evidence of replacement.

3.4 ADJUSTING AND CLEANING

.1 Adjust components and accessories to provide smoothly operating, visually acceptable installation.

.2 Immediately upon completion of installation, clear components, and surfaces. Remove surplus materials, rubbish and debris daily resulting from installation upon completion of work and leave areas of installation in neat, clean condition.

3.5 DEMONSTRATION/TRAINING

.1 Schedule and conduct demonstration of installed equipment and features with The City's personnel.

.2 Schedule and conduct maintenance training with The City's maintenance personnel. Training sessions should include a lecture and demonstration of all maintenance and repair procedures that end user personnel would normally perform.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by mobile storage shelving installation.

END OF SECTION

Part 1 GENERAL

1.1 WORK INCLUDED

.1 Custom fabrication of specialty items.

.2 Supply of standard products.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00, Submittal Procedures.

.2 Shop drawings:

.1 Provide shop drawings clearly indicating all sizes, connections, anchorage, shapes and accessories.

.2 Shop drawings must be submitted prior to ordering materials.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data on all miscellaneous specialty items, including cleaning instructions, and incorporate into The City's maintenance manuals.

1.4 FABRICATION

.1 Verify all dimensions on site prior to fabrication.

.2 Fabricate items in accordance with sizes, profiles, and finishes required.

Part 2 PRODUCTS

2.1 MIRRORS (MIR)

.1 Standard mirror (MIR-1): stainless steel framed, tamper-proof, size: 410mm (16") wide x 760mm (30") high.

.1 Standard of acceptance:

.1 Frost model 941

.2 Bobrick model B-165

.3 ASI Group Canada model 0620

.4 or approved equal

.2 Wall mirror (MIR-2): stainless steel framed, concealed with hanger, size: 610mm (24") wide x 1520mm (60") high.

.1 Standard of acceptance:

.1 Bobrick model B-290

.2 ASI Group Canada model 0600

.3 or approved equal

2.2 GRAB BARS AND FOLD-DOWN GRAB BARS (GB/GBFD)

.1 Style: steel bar in satin chrome, 32mm (1-1/4") diameter, elliptical flange, tamper-proof screws.

.2 Acceptable manufacturers:

.1 Miami Carey
.2 Hubert Industries
.3 Frost
.4 Bobrick
.5 ASI Group Canada
.6 or approved equal

2.3 SYMBOL SIGNS

.1 Standard of acceptance: Frost 694, with wheelchair symbol, braille and text, or approved equal.

.2 Provide one (1) for each washroom with handicapped facilities.

2.4 TOILET BACKREST (BKR)

.1 Surface mounted, stainless steel tube frame with solid plastic laminate backrest. Standard of acceptance: Frost model 1028 Toilet Backrest, or approved equal.

2.5 TOILET PAPER HOLDERS (TPH)

.1 Surface-mounted, double roll toilet tissue dispenser, cast aluminum bracket, satin finish. Theft-resistant spindles shall be moulded from high-impact ABS with retractable pins and concealed locking mechanisms. Unit shall accommodate two (2) standard toilet tissued rolls up to 150mm (6") diameter.

.1 Standard of acceptance:
.1 Bobrick B-2740
.2 ASI Group Canada model 0264-1A2
.3 or approved equal

.2 Provide one (1) dispenser for each water closet.

2.6 HANDS-FREE TOWEL DISPENSERS (TD)

.1 ABS plastic construction, wall-mounted, 8" hands-free towel dispenser, size: 16" high x 13" wide x 10" deep, compatible with rolls with 1-3/4" core or larger. Standard of acceptance: Kimberly-Clark Hands-Free Towel Dispenser – 8", as distributed by Uline, or approved equal.

2.7 HANDS-FREE SOAP DISPENSERS (SD)

.1 Surface-mounted, touchless, hands-free dispenser, ABS and Polystyrene construction, 34 ounce capacity, size: 11" high x 5" wide x 5" deep. Standard of acceptance: Bulk Liquid Soap Auto Wall-Mount Dispenser, model H-7174, as distributed by Uline, or approved equal.

2.8 FEMININE NAPKIN DISPOSAL (FND)

.1 Surface-mounted, satin finish stainless steel, feminine napkin disposal.

.2 Standard of acceptance:

.1 Bobrick model B-270
.2 Frost 622
.3 ASI Group Canada model 0852
.4 Uline H-3454
.5 or approved equal

2.9 COLLAPSIBLE ROBE HOOK (RH)

.1 Spring loaded coat hook, stainless steel type 304 satin finish base, with epoxy coated 18 gauge stainless steel hook. Standard of acceptance: Frost Model 1150, or approved equal.

2.10 STAIR NOSINGS

.1 Anit-slip safety tape: 50mm (2") wide, self-adhesive, colour to be selected by Contract Administrator. Standard of acceptance: Flex-Tred, by Wooster Products Inc., or approved equal.

.1 Location: Stair S01 nosings.

.2 Safety tread insert: extruded aluminum base with abrasive filler, length to suit, colour to be selected by Contract Administrator from manufacturer's full range. Standard of acceptance: Supergrit Safety Tread type 231BF, as manufactured by Wooster Products Inc., or approved equal.

.1 Location: exterior concrete exit stair.
.2 Safety tread to be inserted at time of concrete pour.

2.1 TACTILE WARNING INDICATORS

.1 Truncated dome, stainless steel, anti-slip design, drilled and glued into substrate in strict accordance with manufacturer's instructions. Standard of acceptance: Advantage One TWSI, by Kinesik, or approved equal. Colour to be selected by Contract Administrator from manufacturer's full range.

.1 Location: Main Entry Stair S01 with terrazzo landings.

2.2 TACTILE WARNING SURFACE

.1 Surface applied tiles, truncated domes, installed in strict accordance with manufacturer's instructions. Standard of acceptance: Access Tile, by Kinesik, or approved equal. Colour to be selected by Contract Administrator from manufacturer's full range.

.1 Location: used at steel exit stairs, wood exit stairs with rubber and/or RSF flooring.

2.3 FIRE EXTINGUISHERS

.1 Multi-purpose dry chemical extinguisher, stored-pressure type with hose and shut-off nozzle, ULC labeled for A, B and C fires, 2.27 kg (5 lb), with wall brackets for in-cabinet and wall-mount installation. Standard if acceptance: fire extinguishers as manufactured by National Fire Equipment Ltd., or approved equal.

.2 Carbon dioxide extinguisher, with hose and shut-off nozzle, ULC labeled for B and C fires, 4.54 kg (10 lb), with wall brackets for wall-mount installation. Standard of acceptance: fire extinguishers as manufactured by National Fire Equipment Ltd., or approved equal.

Part 3 EXECUTION

3.1 ERECTION

.1 Install specialties square, plumb, straight, and true, at proper elevations and alignment with other Work, accurately fitted and adjusted by experienced workmen, in accordance with the manufacturer's instructions.

.2 Provide suitable means of anchorage, such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.3 Supply items to be built-in by others, to appropriate trades in adequate time for incorporation into the Work.

.4 Touch-up fastenings and scratched or otherwise damaged surfaces, after completion of installation, to match finish.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI MH30.1 – Industrial Loading Dock Boards (Ramps)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product data: submit manufacturer's data sheets on each product to be used, including:

.1 Seals: indicate unit dimensions, method of anchorage, and details of construction.

.2 Levelers: indicate materials and finish, installation details, roughing-in measurements and operation of unit.

.3 Shop drawings:

.1 Indicate required opening dimensions, tolerances of opening dimensions, placement dimensions, and perimeter conditions of construction.

1.3 QUALITY ASSURANCE

.1 Dock levelers: conform to requirements of ANSI MH30.1.

.2 Installer: company specializing in performing Work of this section with minimum five (5) years experience.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Store products in manufacturer's unopened packaging until ready for installation.

Part 2 Products

2.1 DOCK SEALS

.1 Standard of acceptance: Pentalift PS-100 Fixed Head Dock Seal complete with custom colour fabric to match exterior of building and rain stop head seal.

2.2 DOCK LEVELER

.1 Standard of acceptance: Pentalift Hydraulic Edge of Dock Leveler, 72” wide complete with heavy-duty steel bumper blocks, molded rubber bumpers, master control panel and interlock to overhead door.

Part 3 Execution

3.1 PREPARATION

.1 Clean surfaces thoroughly prior to installation.

.2 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.2 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Set square and level.

.3 Anchor dock leveler units securely, flush with dock.

3.3 ADJUSTING

.1 Adjust installed unit for smooth and balanced operation.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM)

.1 ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

.2 National Fire Protection Association (NFPA)

.1 NFPA 701 – Standard Methods of Fire Tests for Flame Propagation of Textiles and Films

.3 Underwriters' Laboratory of Canada (ULC)

.1 ULC 109 – Flame Tests of Flame Resistant Fabrics and Films

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide samples and shop drawings in accordance with Section 01 33 00, Submittal Procedures.

.2 Samples:

.1 Submit one (1) representative working sample of each type of roller windows shades.

.2 Submit duplicate samples of manufacturer's standard colours for selection by Contract Administrator.

.3 After approval, samples will be returned for incorporation into the Work.

.3 Shop drawings:

.1 Submit shop drawings indicating dimensions in relation to window jambs, operator details, head anchorage details, and hardware and accessories details.

1.3 QUALITY ASSURANCE

.1 All shade systems shall be provided by a single manufacturer who shall take full responsibility for the total project.

.2 Installer: shall have minimum five (5) years' experience in application of products, systems and assemblies specified.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site only when Work of the section can be started.

.2 Before delivery to site, verify each assembly for proper operation. Clean each assembly of marks and smudges prior to providing wrap up protective covering.

1.5 WARRANTY

.1 Manufacturer warranty: warrant work of this section for a period of five (5) years against defects and/or deficiencies in accordance with the General Conditions of the contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Contract Administrator and at no expense to The City. Defects include but are not limited to deformation of members, mechanical failure, failure of system to operate as designed or faulty or poor quality of work.

Part 2 PRODUCTS

2.1 MANUFACTURER

.1 Standard of acceptance: Newton Lite-Lift with Fascia, as manufactured by Altex Inc., or approved equal.

.1 Provide full factory assembled shade unit consisting of two (2) end brackets, shade tube, extruded aluminum fascia, hembar and fabric specified.

.1 Mounting type: between mullions.

.2 Removal must not require the disassembly of the shade unit.

.3 Mounting shall be done using adhesive. Mechanical fastening to the window frame shall not be acceptable.

.4 Provide dual cassette type where indicated on drawings.

2.2 MATERIALS

.1 Performance/Design Criteria:

.1 Design with final determination of limitation on site to meet requirements indicated on Drawings.

.2 Manually chain operated roller window shade system with infinite positioning so shade is capable of stopping and holding at any position within window opening. Provide assemblies to suit adjacent ceilings and finishes. Ensure removal does not require disassembly of shade unit. Left or right hand operative option available to suit design requirements.

.3 Shade system must have an embedded upper limit stop device to ensure a constant upper position and avoid the shade to be over lifted

.4 Roller shade system must be capable of being raised or lowered at a minimum rate of 1 meter per second (1 m/s).

.5 Accessibility:

.1 System must be operable with one hand.

.2 System must be operable at any height while sitting.

.6 Durability:

.1 System must be tested for a minimum of 5500 cycles (one cycle means shade raised fully up and lowered fully down) without any failure.

.2 Formed aluminum: to ASTM B221, Aluminum alloy 6063-T5. Ensure surfaces are free from defects impairing appearance, strength and durability.

.3 Fabrication:

.1 Coordinate and verify job site dimensions affecting this work. Submit in writing dimensions or conditions which vary from those on reviewed Shop Drawings or detrimental to installation. Obtain corrective measures from Contract Administrator prior to fabrication. Ensure suitability of adjacent building components in relationship to work of this section.

.2 Submit in writing defects in work prepared under other sections. Commencement of work implies acceptance of substrates and conditions.

.3 Roller window shade assembly:

.1 Design and fabricate heavy-duty roller window shade assembly to keep maintenance to minimum.

.2 Ensure clutch, spring and sprocket of the roller window shade assembly operates smoothly having capability to control rate of fall, to adjust stop and hold at an infinite number of positions as required.

.3 Ensure assembly mechanism has structural capacity to accommodate specified shades in window sizes required for this Project. Design assembly mechanism to suit size of windows and mass of system.

.4 Roller tube: extruded aluminum roller tube to suit assembly design.

.1 Ensure roller tube is sized and reinforced internally as necessary to prevent excessive deflection in span of tube.

.2 Fabric mounting spline: fabricate slipped-in-place spline of extruded vinyl with asymmetrical insertion locking channels and embossed fabric guide. Ensure spline has sufficient capacity to hold shades when spline is slipped and locked into the tube.

.5 Fascia:

.1 Square fascia to be extruded aluminum alloy 6063T5.

.2 Fascia system should have 89mm minimum and must be square.

.3 Fascia must cover the front and bottom of the shade.

.6 Shade fabric hem tube: hem tube may be extruded aluminum, flat rectangular in shape, designed to hang perfectly perpendicular and contained within a heat welded fabric pocket.

.7 Shade fabrication:

.1 Do necessary cutting and sewing of fabric to produce finished Product having neat, even appearance and meeting performance requirements specified.

.2 Fabricate shades with no vertical or horizontal seams.

.3 Ensure fabric tracks perfectly straight in its movement to within ±1% of its width from fully open to fully closed position and when rolled onto tube, ensure it is stacked in layers to within +/-3 mm (+/-1/8") of edge alignment.

.8 Finishes:

.1 Aluminium: ensure exposed aluminum surfaces are finished clear anodized.

2.3 SHADING FABRIC

.1 Types:

.1 Typical : Altex Series 10 000, 3% open, or approved equal.

.1 Colour: to be selected from manufacturer's full range.

.2 Composition: 70% PVC; 30% Polyester.

.2 Blackout: Altex TexOpaque 6500 Series, or approved equal.

.1 Colour: to be selected from manufacturer's full range.

.2 Composition: 100% Polyester.

.3 Construction: blade colour coating on front and foam coating at back.

.4 Blackout rate: 100%.

.2 Fabric shall be tensioned in finishing range prior to heat setting to keep warp ends straight and minimize or eliminate weave distortion to keep fabric flat. Fabric shall be dimensionally stable.

.3 Performance: as a "shade cloth", fabric shall hang flat, without buckling or distortion. Edge, when trimmed, shall hang straight without raveling. An unguided roller shade cloth shall roll true and straight, without shifting sideways more than 3mm (1/8") in either direction due to warp distortion, or weave design.

.4 Flame retardance: fabric shall be certified by an Independent Laboratory to pass the small-scale vertical burn requirements test ULC 109 and NFPA 701.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Install shades in accordance with manufacturer's instructions in accordance with reviewed Shop Drawings and as indicated, in true, flat planes.

.2 Install blinds at windows as indicated, ends terminated at centre of mullions.

.3 Include centre brackets, where necessary, to prevent deflection of headrail.

.4 Adjust to provide for smooth operation.

.5 Use non-corrosive metal fasteners for installation where allowed, concealed in final assembly.

.6 Instruct The City in proper care and use of manual roller window shades.

END OF SECTION

Part 1 GENERAL

1.1 RELATED WORK

.1 A "legal" hoistway of the exact size specified, properly framed and enclosed and including a pit of proper depth, provided with ladder, drains, lights, access doors, ventilation, and water-proofing, if required.

.2 Suitable machine room, adequate for the elevator equipment, including floors, grating, foundations, lighting, ventilation and heat.

.3 Locate the four (4) inside corners of the elevator pit prior to erection in order that the jack hole may be located and drilled.

.4 Provide clear access including ramps or crane service when necessary for a truck mounted drilling rig to be moved to and from the lowest floor level adjacent to the elevator hoistway prior to erection and excavation of the elevator pit.

.5 Adequate foundations and supports to carry the loads of all equipment, including supports for guide rail brackets. Total pit reaction equals approximately 20,000 pounds dispersed load, guide rail reaction equals approximately 1000 pounds lateral load parallel and 1500 pounds perpendicular to the hoistway side wall.

.6 Provide clear access and make good walls and/or floor for oil line between power unit and jack unit.

.7 All cutting and making good of building structure necessary to permit proper installation of the elevator.

.8 The entire hoistway wall where entrances are to be installed is to be left open or a rough opening provided in accordance with the Elevator Manufacturer's layout drawings until after elevator entrances are installed. Finished walls will then be completed by others. Provide adequate wall supports above all entrance frames. The entrance frames are not designed to support overhead wall loads.

.9 Provide temporary enclosures or other suitable protection for open elevator hoistway during the time the elevator is being installed.

.10 All painting, except as otherwise specified.

.11 When landing doors and frames are provided in prime finish, paint the landing doors and frames after installation.

.12 Provide a drain in the pit. If the drain runs into a sump pit, ensure that the sump pump is located outside the elevator pit. The drain should include a trap and a back-water valve. The discharge from the sump pump shall be routed in accordance with the local Codes having jurisdiction.

.13 Provide in the pit drain an oil separator designed to prevent hydraulic oil form the elevator equipment from entering the sewer system in the event of an oil spill. The oil separator may consist of a separate compartment upstream from the final sump pit and sized to contain a minimum of 15 gallons of oil. The oil separator may also be an oil sensor mounted in the sump pit and wired to disable the sump pump and sound an alarm if oil enters the sump pit.

.14 Provide ventilation as necessary to maintain the machine room temperature between 55 degrees and 90 degrees Fahrenheit (13 degrees and 32 degrees Celsius). The elevator machinery is expected to produce approximately 5100 BTU per hour. The machine room should be vented to outside air.

.15 Provide and maintain proper electric feed wires to the terminals of each elevator control panel with all necessary main line switches, circuit breakers or fused disconnect switches, sized to accommodate a 10 horse power motor.

.16 Furnish, during installation, power of necessary characteristics to provide illumination, operation of required tools and hoist, and for testing and adjusting the elevator and signal equipment.

.17 Provide permanent light fixtures and switches in pit and machine room and at the top of the hoistway. Provide a guard for each light fixture.

.18 Provide permanent dedicated “ground fault interrupter” duplex outlet in the pit and machine room.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

- .1 ASME A17.1 – Safety Code for Elevators and Escalators

.2 Canadian Standards Association (CSA)

- .1 CSA B44 – Safety Code for Elevators
- .2 CSA C22.1 – Canadian Electrical Code
- .3 CSA W47.1 – Certification of Companies for Fusion Welding of Steel
- .4 CSA W59 – Welded Steel Construction (Metal Arc Welding)

.3 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-1.40 – Anticorrosive Structural Steel Alkyd Primer

1.3 QUALITY ASSURANCE

.1 Manufacture material lifts to ASME A17.1/CSA B44, CSA C22.1, CSA W47.1 and CSA W59, local codes and regulations, except where specified otherwise.

.2 Welding to conform to CSA W47.1 and CSA W59 welding codes.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00, Submittal Procedures.

.2 Shop drawings:

.1 Submit complete Shop Drawings for all equipment, hoistway, and pit dimensions, with general arrangement details.

.2 Location and size of the required fused disconnect.

1.5 CLOSEOUT SUBMITTALS

.1 Provide maintenance manuals with details, hydraulic and electrical schematics.

1.6 WARRANTY

.1 Provide one-year written parts and labour Warranty.

Part 2 PRODUCTS

2.1 MATERIAL LIFT

.1 Standard of acceptance: provide Type "B" (w/ rider) Hydraulic Material Lift, by Express Elevators & Lifts Inc. (Contact: 647-355-3097- Mustafa Khambati) Email: mustafa@expresselp.com, or approved equal.

.1 Loading Class ‘A’ – General Freight Loading

.2 Rated load/Capacity: 1,750 lbs uniformly distributed on car

.3 Platform size: 60" width x 84" length x 80" height

.4 Hoistway size: 83” wide x 86” long

.5 Lift speed: 30 FPM up and down

.6 Travel distance: 10’-0”

.7 Overhead clearance: 10’-0”

.8 Pit depth: 4’-0” with no habitable space below pit

.9 Number of landings: two (2)

.10 Number of entrances: one (1) front at Main floor and one (1) rear at Basement

.11 Machine room size: 5'-0" wide x 7'-0" long, to be adjacent to the Hoistway shaft at the Basement floor

.12 Hoistway: site built concrete masonry unit walls by others

2.2 CYLINDER AND PLUNGER

.1 Construct plunger of select chromed shafting, machined true to surface finish of 0.0008mm roughness rating or better.

.2 At top of cylinder provide seal.

.3 Install cylinder and plunger plumb. Operate with minimum friction.

2.3 POWER UNIT

.1 Provide hydraulic system consisting essentially of hydraulic pump, holeless side mounted hydraulic cylinder and piston, pressure relief valve, reservoir, valves, and metal pipe/tubing.

.2 Operate pump continuously in “up” direction, “down” travel shall be by gravity.

.3 Include:

.1 Oil seals, wipers, guide bearings, gaskets, oil connections, and air elimination means.

.2 Pump suction-line strainer.

.3 Fluid-level gauge with minimum fluid level clearly indicated.

.4 Reservoir with filling opening filter and cover, also with reservoir vent that will not allow entry of dust.

.5 Safety orifice at cylinder to control oil flow in case of pipe breakage.

2.4 CONTROL

.1 Control material lift by heavy-duty, constant pressure push-button stations (CPPB).

.2 Push-buttons to be clearly and permanently identified “UP”, “DOWN” and “STOP”.

.3 Provide accurately controlled stopping in both up and down directions and maintain car in any position at which it is stopped until direction button is pressed.

.4 Provide approved limit switch to limit up travel of car.

2.5 MATERIAL LIFT CAR

.1 Construct car of 3/16” steel checker plate in enamel painted finish.

.2 Provide 14 gauge steel panel sides, 80” high.

2.6 HOISTWAY

.1 Per building code requirements, by masonry trade.

2.7 FINISH

.1 Ferrous metal:

.1 Clean metal surfaces and treat with phosphate.

.2 Apply one (1) coat of primer in accordance with CAN/CGSB-1.40.

.3 Apply one (1) coat of alkyd type machine enamel in colour to be selected by Contract Administrator from standard offering of colours.

.2 Fasteners: zinc or cadmium finish.

2.8 DOORS AND FRAME

.1 Double swing nominal opening: 64” wide x 80” high, to allow for clear 60” wide x 80” opening height.

.2 Hollow metal, per elevator code CSA B44.

2.9 POWER SUPPLY

.1 Power supply to be coordinated with Electrical.

.1 Power supply 600/3/60 Volts, fused disconnect in machine room.

.2 Separate lighting supply 120/1/60, GFCI receptacle for machine room.

.3 Separate lighting supply 120/1/60, GFCI receptacle for pit area.

Part 3 EXECUTION

3.1 WELDING

.1 Conform to CSA W47.1 and W59 welding codes.

3.2 FIELD QUALITY CONTROL

.1 Perform and meet tests required by authorities having jurisdiction.

.2 Supply instruments and carry out additional specified to approval of Contract Administrator.

.3 Submit to Contract Administrator test and approval certificates issued by jurisdictional authorities.

END OF SECTION

Part 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1 Division 1 – Temporary utilities, facilities, and controls (protection of floor openings and personnel barriers, temporary power and lighting)

.2 Divisions 26 to 28 – Electrical: telephone (wiring from elevator machine room to telephone controller)

1.2 ALL WORK

.1 In all cases where a device or part of the equipment is referred to in the singular number, provide as many such devices of equipment as are required to complete all work of the section.

1.3 SCOPE

.1 This specification is intended to cover the accessibility modifications to one (1) geared traction hydraulic passenger elevator as detailed, except as specified under "Work Excluded From This Section". All work shall be performed in a workmanlike manner and is to include all labour and material in accordance with the drawings and as specified herein.

1.4 CO-OPERATION

.1 Elevator Contractors are encouraged to understand the full intent and scope of the work before submitting their tender quotations. Where any inconsistency between the various parts of the specification, details incorporated in the drawings, applicable Codes or standard Industry practice are noted, these shall be brought to the attention of the Architect, MCM Architects Inc., Daniel Long (204- 943-7564), e-mail: Daniel Long dlong@mcmarchitects.ca for resolution before tenders close. No questions about the intent of the tender documents, about conflicts or about extra work necessary to bring the various parts of the work together, intended to result in extra charges to the City, will be allowed after the tenders have closed.

1.5 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA B44 – Safety Code for Elevators and Escalators

.2 CSA C22.1 – Canadian Electrical Code

1.6 CODES AND INSPECTIONS

.1 All work shall be performed in accordance with the latest revised edition (as of the date bids are taken) of CSA B44, CSA C22.1, the City of Winnipeg Accessibility Design Standards and/or such Provincial and Local Codes as may be applicable. Elevator Contractor will obtain and pay for all required government permits, inspections, re-inspections as necessary and licenses.

1.7 LIABILITY

.1 The Elevator Contractor shall not be liable for any loss, damage, or delay caused by acts of government, strikes, lockouts, fire, explosions, theft, floods, riot, civil commotion, war, malicious mischief, acts of God, or any cause beyond his reasonable control and on no event shall he be liable for consequential damages.

1.8 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Shop drawings:

.1 Elevator Contractor shall submit drawings showing the cab design. The cab is existing and cannot be changed.

.2 If required by the authorities having jurisdiction, the drawings shall bear the stamp of a professional engineer registered in the Province of Manitoba.

.3 Approval of the drawings (and other approval forms submitted by the contractor) shall in no way limit the responsibility of the contractor to provide a complete installation in accordance with the requirements of this specification.

1.9 SPACE REQUIREMENTS

.1 Confirm in the submitted tender that all items of equipment in this contract can be accommodated in the openings and spaces provided, as shown on the drawings. Failure to do so at the time of tender submission will be construed to mean complete acceptance of the design tender documents, and that any adjustment to the building frame, hoistway and pit sizes or other affected work shall be done at the elevator contractor's expense.

1.10 DOCUMENTS ON SITE

.1 Contractor shall maintain on site a complete set of contract specifications and drawings, including all Addenda incorporated into the specification text at the appropriate place, for the use of elevator mechanic and the City.

1.11 STORAGE

.1 A dry and protected area, conveniently located to the elevator hoistway, will be assigned to the Elevator Contractor without cost, for storage of his material and tools.

1.12 WARRANTY

.1 Elevator Contractor shall warrant the equipment installed by him under these specifications against defects in materials and workmanship, and will correct any defect not due to ordinary wear or tear or improper use or care which may develop within one year (1) from the date each elevator is completed and placed in operation.

.2 Warranty is not intended to supply normal maintenance service and shall not be construed to mean that the Elevator Contractor will provide free service for periodic examination, lubrication, or adjustment due to normal use beyond that included in the Specification; nor will the Elevator Contractor correct without charge breakage, maladjustments, or other trouble arising from abuse, misuse or any other causes beyond his control.

1.13 WORK EXCLUDED FROM THIS SECTION

.1 This specification does not include the following work and is subject to the proper performance of such work by others.

.1 Supply and install sheet vinyl, vinyl tile or carpet flooring for the elevator cab as specified.

.2 Furnish in place all fixed conduits, wiring and fittings for remote the new car telephone with wiring terminating at the elevator controller in the machine room.

Part 2 PRODUCTS

2.1 NEW CAR STATION

.1 Remove and dispose of existing car station and provide new car station.

.2 Provide new car station. Arrange car operating buttons at bottom of car stations in accordance with requirements of Appendix E of the Elevator Code. Provide buttons with minimum 1 full inch diameter pressel (this is larger than the Appendix E requirement). Provide fishtail raised tactile and Braille markings located immediately to the left of each button. Mount key switches for INDEPENDENT SERVICE, LIGHT and FAN, HOISTWAY ACCESS, BATTERY CAB LIGHT TEST and STOP at the top of new car station.

.3 Provide stainless steel vandal proof push buttons with fishtail tactile and Braille marking plates.

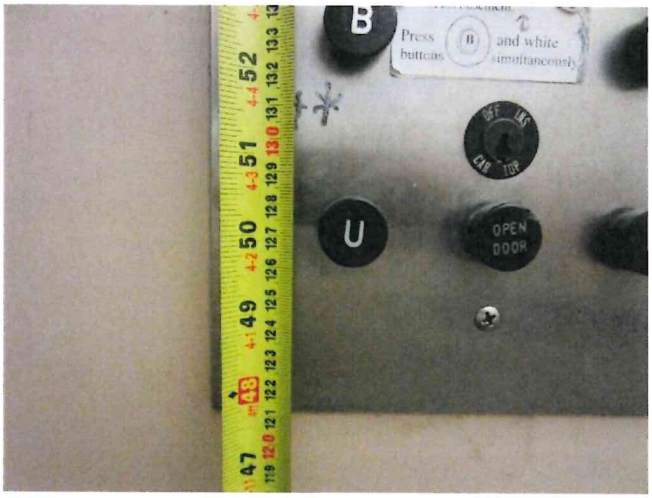
.4 Mount the lowest car button at 35" above the floor and provide an extended faceplate high enough to cover the old car station cut-out and to accommodate new Car Position Indicator. Do not mount any push button higher than 48" above the floor.

.5 Provide LED illumination for call-registered lights in the car call and ALARM buttons and audible call registered buzzer.

.6 Engrave the elevator number "E1" into the car station.

.7 Provide a certificate holder to display the Operating License.

.8 Ensure that no trademarks are visible in the car station (or any other visible parts of the elevator installation).



Height of existing car station

Height of existing car station

2.2 BATTERY EMERGENCY CAB LIGHTING

.1 Supply and install battery emergency cab lighting for the elevator, incorporated into new car station. Arrange the controlling circuitry so that when power is removed from the normal lighting circuit, the battery emergency cab lighting will automatically activate and provide sufficient lighting at Car Operating Panel. Provide batteries of adequate capacity to maintain adequate lighting in the car for a minimum of four (4) hours. Provide an automatic battery charger to maintain the batteries at full charge at all times between uses.

.2 Provide a TEST keyed switch in the car station to provide a convenient means of testing the emergency cab lighting system.

.3 Provide, as part of the emergency cab lighting equipment, an alarm bell connected to the alarm button in the car station. Arrange the alarm bell to sound with or without the normal cab lighting power supply.

2.3 VOICE ANNUNCIATOR

.1 Provide voice annunciator in elevator car. Arrange voice annunciator to announce floor name each time elevator stops at a floor, direction of travel of the next trip and special advisory messages such as instructions such as to clear the doorway, etc. Provide quality speaker such that voice enunciator can be clearly understood anywhere in the cab. Provide volume control, preferably mounted behind car station.

2.4 TELEPHONE

.1 Co-ordinate with the City who will provide a new telephone line to elevator machine room.

.2 Supply and install hands-free autodial telephone, Style OEM-150, as manufactured by Webb Electronics or approved equal, mounted integral with car station. Provide push button complete with raised collar (to prevent accidental activation of the telephone button) in car station with telephone symbol in red. Provide perforations in car station cover plate for the telephone microphone and speaker so that telephone is completely vandal resistant. Arrange that when telephone push button is pressed the phone automatically dials a pre-set number. Program phone to call elevator maintenance provider's dispatch centre. Provide quality telephone such that clear communication is provided for the passengers from any point in the car. Arrange phone to automatically hang up only when the call is terminated from outside the car to allow further calls to be placed. Arrange that phone can receive calls from outside the car. Arrange that phone can continue to operate during a power failure.

.3 Program telephone so that it automatically announces the building location and car number.

2.5 CAR POSITION INDICATOR

.1 Remove and dispose of old Car Position Indicator.

.2 Provide new Car Position Indicator, mounted at top of car station. Position Indicator shall be segmented digital type with 2.2" characters arranged to show location for the elevator as it travels through the hoistway. Include direction arrows in Position Indicator to show future direction of travel of car.

2.6 FLOOR PASSING GONG

.1 Provide an audible gong to sound each time elevator passes or arrives at a floor.

2.7 CAR RIDING LANTERN

.1 Supply and install Car Riding Lantern flush-mounted in car door post. Arrange the control to cause the appropriate arrow to illuminate, indicating direction in which car will travel after it closes its door. Provide, in conjunction with Car Riding Lantern, a gong to sound once for the UP and twice for the DOWN direction.

.2 Arrange the control so that the Car Direction Lanterns illuminate and chime for each stop, whether for a car call or for a hall call.

.3 Locate Car Direction Lantern centre 6'-0" above cab floor.

.4 There is no existing Car Riding Lantern.

2.8 HALL POSITION INDICATOR

.1 Remove and dispose of the old Hall Position Indicator.

.2 Provide new Position Indicator for the car with 2.2" high segmented digital numbers. Include direction arrows to show the future direction of travel of the car. Provide new Hall Position Indicator in separate surface-mounted fixture mounted above the new hall push buttons, approximately 6'-0" above the floor. Provide blank stainless steel cover plate sized to cover existing back box.

2.9 HALL CALL STATIONS

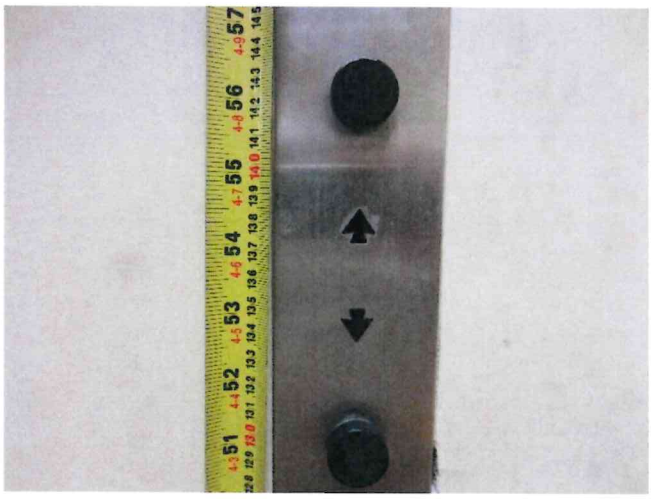
.1 Remove and dispose of old hall push button fixtures.

.2 Supply and install hall call station at each landing (total of five (5)). Provide LED illumination for call registered lights in hall call buttons. Provide stations call buttons centred at 42" above floor. Mount new hall push buttons in new surface-mounted fixtures.

.3 Extend new cover plates high enough to cover old back-boxes and to allow the "In Case of Fire..." pictograph shown as Figure 2.27.9 of CSA B44 to be engraved and paint filled on the cover plate.

.4 Provide stainless steel vandal proof push buttons.

.5 Arrange hall push buttons to sound once when call is registered.



Height of existing hall push bottoms

2.10 DOOR OPERATOR

.1 Remove and dispose of existing door operator.

.2 Provide quality gearless door operator such as the GAL model MOVFR or approved equal powered by a direct current motor with SCR drive or an A C motor with VVVF drive. Provide door operator control such that door opening and door closing speeds can be adjusted independently. Provide closed loop position and velocity control for door operator capable of adjusting the point of slowdown and the slowdown torque to compensate for a variety of building conditions. Provide smooth opening and closing and cushioning at final limits of door travel. Door operator shall provide door open time of 3.0 seconds and door close time of 4.0 seconds. Provide control to reverse doors within 2.5" of breaking the photocell beam at any point over the entire travel of the doors.

.3 Arrange door operation such that the doors remain open for minimum of 5.0 seconds when stopping in response to both car and hall calls.

.4 Replace car door track.

2.11 DOOR RESTRICTOR

.1 Provide door restrictor mechanism to prevent cab door from being opened from inside of cab when car is outside of landing zone, as defined in CSA B44.

2.12 DOOR OPERATOR HARDWARE

.1 Supply and install new door operator clutch for car door and new landing door interlocks and hall door pick-up roller assemblies at each landing entrance (total of five (5) sets).

.2 Adjust doors for smooth and quiet operation.

2.13 PROVISIONS FOR THE HANDICAPPED

.1 Provide features to assist handicapped persons using wheelchairs, as detailed in Appendix E of Elevator Code and the City of Winnipeg Accessibility Design Standard. Mount car and hall fixtures at handicapped height; provide audible car and hall call registered sound; provide tactile and Braille plates adjacent to car and hall buttons and on landing door jambs; provide multi-beam infra-red photo cell protection for car door complete with 3-D protection extending onto the landing; provide stainless steel handrails on three (3) sides of car cab; provide car riding lantern in car door jamb complete with gong to indicate future direction of travel of car.

2.14 PHOTOCELLS

.1 Remove and dispose of existing multi-beam safety edge. Supply and install new multi-beam infra-red photocells to protect the elevator doorway and to provide 3-D triangular zone of protection on landing in front of car doors of each car. Provide at least 40 beams projecting horizontally across the car entrance providing detection over the whole area from 6" to 6 feet above the car sill. Provide, in addition, a zone of detection projecting out onto corridor side of elevator doors, capable of detecting an obstruction before it enters the doorway. Photocell device shall contain an automatic failure protection feature. If the door is held open in excess of 25 seconds by actuation of the photocell device, photocell shall be disconnected from the door open circuit. Doors shall be allowed to close, but at reduced speed and torque, as detailed in the Elevator Code. In the event of failure of the photocell device or if the device times out, a buzzer shall sound while the doors are closing to warn passengers that the detection feature is inoperable. In addition, if the triangular portion of the door protection device senses an obstruction but the doorway portion does not and this condition persists for a period of twenty seconds, disable the triangular portion and allow the doors to close with reference to the doorway portion only.

2.15 CAB FINISHES

.1 Provide new horizontal plastic laminate wall finish in cab supplier's standard range, rigidized stainless steel and laminated glass mirror as detailed below, mounted on top of existing flat wall steel cab panels. Supply and install new raised stainless steel foreground trim around plastic laminate and stainless steel finishes. Alternately, provide raised panels finished as specified with stainless steel background. Both arrangements are acceptable under this specification.

.2 Provide single horizontal sheet finished in rigidized patterned stainless steel mounted below the handrail directly on top of the existing flat wall cab panels on rear wall and each side wall above the existing 6" stainless steel kickplate. Provide for each side wall two (2) horizontal panels finished in plastic laminate mounted above the handrail and mounted directly on existing flat wall finish. Provide for rear wall a single horizontal panel finished in plastic laminate mounted above handrail up to height of 2000mm above the cab floor and mounted directly on existing flat wall finish. Provide for rear wall a laminated glass mirror running from height of 2000mm (6'-7") up to the beginning of the ceiling structure and full width of cab and angled downward so that passenger in wheelchair and facing rear of cab can see the car door. Provide stainless steel trim for mirror. Mount all new finishes complete with stainless steel foreground (or background) inserts between, above and below each panel.

Existing steel flat wall cab design

.3 Provide 1½" stainless tubular handrails with ends returned on three (3) walls of cab mounted at 850mm (2'-10") to 900mm (3'-2") above cab floor.

Height of existing handrails

Typical modernized wall panel layout (mirror on back wall)

Typical modernized raised stainless steel trim detail

.4 Retain existing light trough.

.5 Provide new LED lighting in existing light trough, complete with guards.

.6 Skin existing cab front return panel, header, and cab door in brushed #4 stainless steel.

.7 Provide new pads and pad buttons to cover all four (4) walls.

.8 Paint in white enamel the existing light trough and ceiling above the new plastic laminate and mirror wall finish.

Existing light trough and ceiling

.9 Submit complete shop drawings for cab design for approval prior to fabrication.

.10 Examine all car door rollers and replace any which show a worn liner, flat spots or worn bearings. Similarly inspect and replace any worn car door gibs.

2.16 CAB FANS

.1 Wire existing cab fan through new keyed switch in new car station.

2.17 LANDING ENTRANCES

.1 Retain existing five (5) sets of single-speed power operated entrances which provide a clear opening 3'-0" wide by 7'-0" high.

.2 Provide entrance jamb tactile plates on both entrance jambs at all floors, mounted at 5'-0" above finished floor, finished in stainless steel. Include both raised markings and matching Braille.

.3 Fill damaged portions of landing door frames with suitable filler and paint landing doors and frames in quality enamel paint.

END OF SECTION

Part 1 GENERAL

1.1 CODES AND STANDARDS

.1 All drawings and all sections of the specifications shall apply to and form an integral part of this section.

.2 Comply with and adhere to all applicable, codes, standards and applicable bylaws of the authority having jurisdiction.

.3 Where there is a conflict between the drawings and specifications and applicable codes or standards or requirements of the authority having jurisdiction the more restrictive condition shall apply.

1.2 SCOPE OF WORK

.1 Refer to front end specifications and adhere to all requirements as specified.

.2 Work to include all labour, material and equipment required for installing, testing and commissioning of mechanical systems as detailed in other sections of Divisions 21 to 23.

.3 All mechanical work to be bid as a single complete sub-Contract even though work of various mechanical trades has been subdivided.

.4 It is the responsibility of the Mechanical Subcontractor to co-ordinate the work among the various mechanical sub-trades to ensure complete functioning systems.

1.3 EXISTING CONDITIONS

.1 Examine site, existing adjacent buildings and local conditions affecting work under this Contract. Examine Structural, Architectural, Mechanical and Electrical and all other Contract drawings to ensure work can be performed without changes to the building as shown on drawings. No allowance will be made later for necessary changes, unless notification of interferences have been brought to the Contract Administrator's attention, in writing, prior to closing of tenders.

.2 Ductwork and Duct Components:

.1 The Contractor is advised that detailed site investigations are to be carried out prior to fabrication and construction of duct and duct components; verify the size, orientation, location and supports required for, duct to equipment transitions and new duct to existing duct connections.

.2 Drawings and equipment specifications are based on the best information available at time of Bid Opportunity and are subject to revision based on reviewed shop drawings received during the project submittals process.

.3 Contractors shall include all necessary allowances in their bid price for minor changes that adjust tie-in locations and duct sizes to meet equipment shop drawing requirements and as-found conditions.

.4 The following allowances shall be considered minor and incidental to the price bid. No claims for extra will be considered by the Contract Administrator for modifications required to accommodate these minor changes,

.1 Duct diameter or duct rectangular dimensions, ±50mm,

.2 Tie-in location to existing ductwork, ±3.0 m in all directions,

.3 Duct routing, deviation from duct centreline shown, ±2.0 m in all directions,

.4 Fittings additional to that shown on drawings,

.5 Fittings required to achieve temporary, partial operation of any air moving system in accordance with the stated phased construction implementation schedule.

.3 Plumbing and Piping Systems:

.1 The Contractor is advised that detailed site investigations are to be carried out prior to fabrication and construction of plumbing and piping systems and piping components; verify the size, orientation, location and supports required for, pipe to equipment transitions and new pipe to existing pipe connections.

.2 Drawings and equipment specifications are based on the best information available at time of Bid Opportunity and are subject to revision based on reviewed shop drawings received during the project submittals process.

.3 Contractors shall include all necessary allowances in their bid price for minor changes that adjust tie-in locations and pipe sizes to meet equipment shop drawing requirements and as-found conditions.

.4 The following allowances shall be considered minor and incidental to the price bid. No claims for extra will be considered by the Contract Administrator for modifications required to accommodate these minor changes,

.1 Pipe diameter dimensions, ±40mm,

.2 Tie-in location to existing plumbing and piping, ±3.0 m in all directions,

.3 Pipe routing, deviation from pipe centreline shown, ±3.0 m in all directions,

.4 Pipe fittings additional to that shown on drawings,

.5 Fittings required to achieve temporary, partial operation of any piping system in accordance with the stated phased construction implementation schedule.

.4 The Mechanical Subcontractor shall take all steps necessary to make any affected sub-trades of the renovation allowances stated above aware of these allowances and shall enforce these allowances; no Change Orders will be considered for renovation allowances stated above, the decision of the Contract Administrator is final.

1.4 SITE SERVICE INFORMATION

.1 Location, routing and depth of existing mechanical services shown on drawings including sanitary sewers, water mains and other utilities are based on recorded information and are approximate only. Contractor and his sub-trades shall verify exact location at jobsite.

.2 Obtain The City's approval before commissioning systems and putting into service.

1.5 PERMITS AND REGULATIONS

.1 Obtain all permits and pay all fees for performing the work.

.2 Review drawings with authorities having jurisdiction to ensure compliance with all applicable codes and bylaws.

1.6 EXECUTION OF WORK

.1 Install work in advance of concrete pouring or similar work. Provide and set pipe sleeves and equipment anchors as required.

.2 Install concealed pipes and ducts neatly, close to building structure so furring is minimum size. Pipes, ducts and equipment installed improperly, to be removed and replaced without cost to The City.

.3 Protect and maintain work until building has been completed and accepted. Protect work against damage during installation. Cover with tarpaulins if necessary. Repair all damage to floor and wall surfaces resulting from carrying out work, without expense to The City.

.4 During welding or soldering ensure structure is protected against fire by shielding, using fire-rated sheets or galvanized iron sheets. Contractor shall provide trained persons armed with suitable type extinguishers, to watch for and extinguish sparks, etc.

.5 Co-ordinate work with other sections to avoid conflict and ensure proper installation of all equipment. Review all Contract drawings.

.6 On completion of work, remove tools, surplus and waste material and leave work in clean, perfect condition.

1.7 WARRANTY

.1 Warranty satisfactory operation of all work and apparatus installed under this Contract. Replace, at no expense to The City, all items which fail or prove defective within a period of one year after final acceptance of complete Contract by The City, provided such failure is not due to improper usage by The City. Make good all damage to building incurred as a result of failure or repair of mechanical work.

.2 No certification given, payment made, partial or entire use of equipment by The City, shall be construed as acceptance of defective work or acceptance of improper materials. Make good at once, without cost to The City all such defective work or

materials and consequence resulting there from, within one year of final acceptance date.

.3 This general guarantee shall not act as a waiver for any specified guarantee and/or warranty of greater length of time noted elsewhere in these documents.

1.8 ENGINEERING INSPECTIONS

.1 Contractor's work will be inspected periodically by The City, and/or Contract Administrator or their representatives, solely for purpose of determining general quality of work, and not for any other purpose. Inspection and directives given to Contractor does not relieve Contractor and his agents and employees of their responsibility to erect and install work in all its parts in a safe and workmanlike manner, and in accordance with plans and specifications, nor impose upon The City, and/or Contract Administrator or their representatives, any responsibility to supervise or oversee erection or installation of any work.

1.9 MECHANICAL SHOP DRAWINGS

.1 Submit for review no more than six sets of detailed shop drawings for all mechanical equipment noted in other sections of Divisions 21 to 23. Alternately the Contractor may elect to submit shop drawings in PDF file format provided all requirements of clause 1.10 are met.

.2 Check shop drawings for conformity to plans and specifications before submission.

.3 Each drawing shall bear Divisions 21 to 23 stamp with Firm's name, date of review and shall be initialled by the responsible officer of Divisions 21 to 23. Include name of project, equipment supplier and clause number equipment is specified under.

.4 Clearly show division of responsibility. No item, equipment or description of work shall be indicated to be supplied or work to be done "by Other's or by Purchaser". Any item, equipment or description of work shown on shop drawings shall form part of the Contract, unless specifically noted to contrary.

.5 Take full responsibility for securing and verifying field dimensions. In case where fabrication must proceed prior to field dimensions being available, check all shop drawings and approve for dimensions only. In this case guarantee that dimensions will be worked to and ensure that other sub-trades are aware of these dimensions and shall comply with them.

.6 Review by Contract Administrator shall be mutually understood to refer to general design only. If errors in detailed dimensions or interference with work are noticed, attention of Contractor will be called to such error or interferences, but Contract Administrator's review of drawings will not relieve Contractor from responsibility for said error or interferences, or from necessity of furnishing such work, and materials as may be required for completion of work as called for in Contract Documents.

1.10 MECHANICAL SUB-TRADES

.1 State in tender, names of all sub-trades to be used in mechanical work.

.2 Contractor to have minimum five years experience in field of mechanical contracting and to have successfully performed work of similar nature and approximate size to that indicated in specifications and on drawings. Sub-trades shall employ, on this project, foremen or supervisory personnel who have had similar experience to that required by the Contractor.

1.11 MECHANICAL DESIGNATED TRADES

.1 All works by the Mechanical Subcontractor, and any Sub-Contractors, in a designated trade as regulated by The Apprenticeship and Certification Act shall be supervised by personnel with a Certificate of Qualification from the Province of Manitoba in that designated trade.

.2 Mechanical Subcontractor, and any Sub-Contractors, shall provide proof of Certificate of Qualification at the request of the Contract Administrator.

1.12 OPERATING AND MAINTENANCE MANUALS

.1 Provide operation and maintenance data for incorporation into O&M manuals.

.2 Draft operation and maintenance manual to be approved by, and final copies deposited with, Contract Administrator before final inspection.

.3 General:

- .1 Include a title page bearing the name of the project, The City, and installing Contractor.
- .2 Table of contents.
- .3 List of sub-contractors, identifying the scope of work they completed on the project.
- .4 List of equipment/material suppliers, identifying the equipment/materials they provided.

.4 Project documentation to include:

- .1 Installer's warranty certificate.
- .2 Copy of permits issued by Authority having Jurisdiction.
- .3 Copy of approvals and proof of inspections from Authority having Jurisdiction.
- .4 Copy of material and systems tests including balancing report, fire damper test report, water treatment results, pressure tests, etc.
- .5 Copy of approved equipment and material shop drawings.

.5 Operation data to include:

- .1 Control schematics for each system.
- .2 Description of each system and its controls for control systems not provided by The City's control Contractor.
- .3 Description of operation of each system at various loads together with reset schedules and seasonal variances.
- .4 Operation instruction for each system and each component.
- .5 Description of actions to be taken in event of equipment failure.

.6 Valve schedule and flow diagram.
.7 Colour coding chart.

.6 Maintenance data shall include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
.2 Data to include schedules of tasks, frequency, and tools required and task time.

.7 Performance data to include:

.1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.
.2 Equipment performance verification test results.
.3 Special performance data as specified elsewhere.

.8 Additional Data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions

.9 Approvals:

.1 Submit two (2) copies of draft Operation and Maintenance Manual to Contract Administrator for approval. Submission of individual data will not be accepted unless so directed by Contract Administrator.
.2 Bind data in 3-ring binder with indexed tabs, table of contents, and contact personnel for Contractors, sub-contractors, vendors and suppliers, and repair and maintenance.
.3 Make changes requested by Contract Administrator and resubmit (3) final copies and a flash drives including the PDF file of the bound O&M manual.

1.13 DRAWINGS

.1 Drawings are diagrammatic only and do not show all details. Information involving accurate measurements of building to be taken from Architectural Drawings and/or at the building. Make without additional expense to The City, all necessary changes or additions to runs to accommodate structure conditions. Locations of pipes, ducts and other equipment to be altered without charge to The City, provided change is made before installation and does not necessitate additional materials and that Contract Administrator ratifies all such changes and recorded on Record Set of Drawings.

.2 Drawings and specifications to be considered as an integral part of Contract Documents. Neither drawings nor specifications to be used alone. Misinterpretation of requirements of plans or specifications shall not relieve Contractor of responsibility of properly completing work to approval of Contract Administrator.

.3 It is the mechanical Contractor's responsibility to ensure that all subcontractors and suppliers are aware of and conform to all Contract requirements indicated on both the drawings and specifications.

.4 As work progresses, and before installing piping, ductwork, fixtures and equipment interfering with interior treatment and use of building, consult Contract Administrator for comments. This applies to all levels and proper grading of piping. If Contractor fails to perform above checking and fails to inform Contract Administrator of such interference, Contractor to bear all subsequent expense to make good the installation.

.5 Drawings indicate general location and route to be followed by pipes and ducts. Where required piping is not shown on plans or only shown diagrammatically, install in such a way as to conserve headroom and interfere as little as possible with free use or space through which they pass.

.6 Refer to Architectural Drawings for roof construction details. These shall relate to roof supports, piping penetrating roofs, etc. as indicated on the mechanical drawings.

1.14 MATERIALS – EQUALS AND ALTERNATES

.1 Acceptable manufacturers of specified materials and equipment are named in this specification for the purpose of establishing the standard of materials and workmanship to which Contractor shall adhere. The tender price shall be based on the use of materials and equipment as specified.

.2 Materials of same general type are to be from the same manufacture (eg: all air supply units shall be same manufacturer). The Contractor shall ensure that all sub-trades provide products of same manufacturer.

.3 Equipment listed as "equal" in specifications or submitted as alternate by Contractor must meet all space requirements, specified capacities and must have equipment characteristics of specified equipment as interpreted by Contract Administrator. Install equipment in strict accordance with manufacturer's published recommendations. Any variations to installation, additional work required or additional equipment required to meet the specified and designed drawing of the "equal" equipment that is not required for the specified product shall be the responsibility of the Contractor and/or supplier.

.4 Equipment and material shown on drawings and not specified herein, or specified herein and not shown on drawings, shall be included in this Contract as though both shown and specified.

1.15 EQUIPMENT INSTALLATION

.1 Unions or flanges: provide for ease of maintenance and disassembly.

.2 Space for servicing, disassembly and removal of equipment and components: provided as recommended by manufacturer or as indicated.

.3 Equipment drains/Relief Valves: pipe to floor drains, minimum drain size NPS 1 complete with tees and cleanouts for easy cleaning.

.4 Contractor responsible for coordination with The City for final equipment locations.

.5 Relocate equipment as indicated on the drawings. Be fully responsible for damage to equipment until accepted by The City at project completion.

1.16 PROTECTION OF OPENINGS

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

1.17 CONCEALMENT OF PIPING

.1 In finished areas, conceal all pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise on drawings or in specifications.

.2 Before installation inform the Contract Administrator if there is a contradictory situation. Install as directed.

1.18 SAMPLES

.1 Submit for Contract Administrator's review such standard manufacturer's samples as the Contract Administrator may reasonably require.

.2 Submit samples as for procedures describing shop drawings, with reasonable promptness and in an orderly sequence, so as to cause no delay in the work.

.3 Notify the Contract Administrator in writing, at the time of submission, of any deviations in samples from requirements of Contract Documents.

.4 Submit samples in sizes and quantities requested.

.5 Where colour, pattern or texture is criterion, submit full range of samples.

.6 Construct field samples at locations acceptable to Contract Administrator.

.7 Reviewed samples will become standards of workmanship and material against which, installed work will be checked on project.

1.19 ROOF PENETRATIONS

.1 Submit shop drawings indicating proposed material, reinforcement, anchorage, fastenings and method of installation. Construction details shall accurately reflect actual job conditions.

.2 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions sufficient for identification at job site. Include manufacturer's printed instructions for installation, including section or other type details.

.3 Perform work in accordance with Specification Section 07 72 00.

1.20 PRESSURE TESTING OF PIPING SYSTEMS

.1 Give minimum 48 hours written notice of date for testing.

.2 Insulate or conceal work only after testing has been completed, reviewed and approval by the Contract Administrator.

.3 Conduct tests in presence of Contract Administrator.

.4 Pipe pressure testing requirements:

- .1 General:
  - .1 Maintain test pressure, without loss for 4 hours unless otherwise specified in applicable codes.
- .2 Fire Protection Systems:
  - .1 To NPFA 13 and requirements of Authority having Jurisdiction.
- .3 Potable Water Systems:
  - .1 To Manitoba Plumbing Code and requirements of Authority having Jurisdiction
- .4 Sanitary Sewer, Storm Sewer and Venting Systems:
  - .1 To Manitoba Plumbing Code and requirements of Authority having Jurisdiction.
- .5 Natural Gas System:
  - .1 To CAN/CSA-B149.1 Natural Gas and Propane Installation Code and requirements of Authority having Jurisdiction.
- .6 Refrigeration Systems:
  - .1 To CSA B52 Mechanical Refrigeration Code and requirements of Authority having Jurisdiction.
- .7 Hydronic Heating & Cooling Systems:
  - .1 To ASME B31.9 Building Services Piping, para. 937.

.5 Equipment: test as specified by manufacturer.

.6 Prior to pressure testing isolate all equipment or other equipment/materials which are not designed to withstand test pressures or test medium.

.7 Should additional testing be required, or testing be redone, the Contractor shall bear all costs related to additional testing.

.8 Once pressure testing is completed, submit pressure test reports for review. Pressure test report shall include, but not be limited to:

- .1 System being tested, and applicable pressure test code/standard.
- .2 Date and time the test(s) was performed, and who the test was performed by.
- .3 If system was tested in sections, identify which section.
- .4 Test medium, and medium temperature.
- .5 Pressure at which test was performed at.
- .6 Duration of pressure test.
- .7 System pressures at beginning and end of test.

.8 Time stamped photos of pressure gauges before and after completion of pressure test.

1.21 SPECIAL TOOLS

.1 Provide one set of special tools required to service equipment as recommended by manufacturers.

.2 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.22 SPARE PARTS

.1 Furnish spare parts as follows:

.1 One set of packing for each pump.
.2 One casing joint gasket for each size pump.
.3 One head gasket set for each heat exchanger.
.4 One glass for each gauge glass.
.5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 21 05 01 General Provisions – Mechanical.

.3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.23 TRIAL USAGE

.1 The City reserves the right to use any piece of mechanical equipment, device or material installed under this Contract, for such reasonable lengths of time and at such times as Contract Administrator may require, to make complete and thorough test of same, before final completion and acceptance of any part of Contract. It is agreed and understood, that no claim for damage will be made for any injury or breakage to any parts of the above due to aforementioned tests, whether caused by weakness or inaccuracy of parts, or by defective materials or workmanship of any kind whatsoever. Supply all labour and equipment for such tests.

1.24 SAFETY DEVICE TESTING

.1 Make complete inspection of all safety devices to ensure:

.1 That safety devices are complete in accordance with specifications and manufacturer's recommendations.
.2 That the safety devices are connected and operating according to all local regulations.

1.25 TEMPORARY USE OF EQUIPMENT

.1 Permanent systems and/or equipment is not to be used during construction period without Contract Administrator's written permission.

.2 Equipment used during construction period to be thoroughly cleaned and overhauled. Replace work or damaged parts so equipment is in perfect condition, to entire satisfaction of Contract Administrator and The City.

.3 Provide proper care, attention and maintenance for equipment while it is being used. If in opinion of Contract Administrator, sufficient care and maintenance is not being given to equipment and systems, Contract Administrator reserves the right to forbid further use of said equipment and systems.

.4 Temporary use of equipment shall in no way relieve Contractor of providing twelve month guarantee period to commence as of date of final acceptance of building by The City as interpreted by Contract Administrator.

.5 All air filters and pipe strainers are to be replaced prior to turning systems over to The City.

1.26 INSTRUCTIONS TO THE CITY'S PERSONNEL

.1 Contractor to schedule and co-ordinate start-up supervision and instruction of The City's personnel required of individual equipment suppliers as noted in other sections of Divisions 21 to 23. Contractor's construction supervision is also required to instruct The City's personnel in operation and maintenance of all equipment and systems to satisfaction of Contract Administrator.

.2 Provide The City with three copies of O&M manuals incorporating following:

.1 Service instructions – including lists of spare and replacement parts and names and addresses of suppliers.
.2 Maintenance & Operating instructions.
.3 Revised shop drawings.

.3 Provide The City with one set of Asbuilt Drawings.

.4 Forward manuals and drawings to Contract Administrator prior to final acceptance. Final payment will not be made until all required manuals have been received.

.5 Review instructions with The City's representative to ensure a thorough understanding of equipment and its operation.

1.27 TEMPORARY HEATING

.1 Written permission to be obtained from Contract Administrator to use permanent heating system for temporary heat. Systems to be operated in strict accordance with Contract Administrator's recommendations.

1.28 ASBUILT DRAWINGS – ELECTRONIC

.1 Contractor to provide CAD Asbuilt drawings as part of project close out.

.2 Drawings shall be DWG file format and delivered to Contract Administrator on electronic storage media (CD, DVD or USB).

.3 CAD Asbuilt drawings shall contain all changes as noted in physical Asbuilt drawings.

.4 The Contract Administrator will conditionally release all drawings in CAD format to the Contractor on the Contract Administrator's reception of a completed *Release Form: CADD/Electronic File Transfer to Contractor* as provided by the Contract Administrator.

1.29 ASBUILT DRAWINGS - PHYSICAL

.1 Provide one set of Asbuilt Drawings, marked clearly in red pencil, with all changes and deviations from piping and ductwork, etc. shown on Contract Drawings, including all Work Order Changes.

.2 Asbuilt drawings to be maintained on a weekly basis by the Contractor to ensure they are up-to-date and accurate. Drawings shall be made available for reference purposes and inspection.

.3 Provide The City with one set of drawing prints with all "Asbuilt" changes noted. Eradicate piping and/or ductwork, etc. shown on original drawings that has been affected by the changes.

.4 Include asbuilt stamp on each drawing indicating the words "Asbuilt Drawing" with the Contractor's name and date.

.5 Perform testing, adjusting and balancing for HVAC using asbuilt drawings.

1.30 PAINTING

.1 Apply at least one coat of corrosion resistant primer paint and finish coat to ferrous supports and site fabricated work.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up.

.4 For any required painting of mechanical equipment or appurtenances, confirm colour with The City before painting.

1.31 CLEANING

.1 Project Cleanliness

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by The City or Sub-Contractors.
.2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by. Do not burn waste materials on site.
.3 Clear snow and ice from access to building.
.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.5 Provide on-site containers for collection of waste materials and debris.

.6 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.

.7 Store volatile waste in covered metal containers, and remove from premises at end of each working day.

.8 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

.9 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.10 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

.2 Final Cleaning:

.1 Refer to Section 01 74 00 Cleaning and Waste Management.

1.32 CUTTING AND PATCHING

.1 General.

.1 The equipment and piping installation work specified in this Contract includes the installation by the Contractor of equipment, piping and materials supplied by the Contractor. Cutting and patching of the existing structure is required to implement this work. Providing the necessary cutting and patching and related Architectural and civil works shall be co-ordinated by and provided by the Contractor using trade persons skilled and regularly involved in the work being carried out. These works may be simply detailed/described on the drawings or specifications; it is the responsibility of the Contractor to fully investigate and provide the services and materials necessary to execute these works.

.2 Contractor to obtain and pay for x-ray analysis prior to any penetrations through structural concrete members required for the mechanical works.

1.33 EQUIPMENT WARRANTIES AND ACCEPTANCE

.1 Quality Warranty

.1 Manufacturer warrants that equipment furnished shall conform to description and specifications contained herein and shall be free from all defective materials and workmanship and all defects due to design. Upon The City's request, manufacturer shall, at its sole expense, promptly repair or replace, all or any part of said equipment which is defective in any respects, within 1 year from the date of acceptance by The City after all tests have been complete to satisfaction of Contract Administrator. This does not apply to failure of equipment due to improper usage.

1.34 TAKE OVER PROCEDURES

.1 Prior to application for Certificate of Substantial Performance, the Contractor shall carefully inspect the minor construction deficiencies are complete and/or corrected and that the building is clean and in condition for occupancy. Notify the Contract Administrator in writing, of satisfactory completion of inspection and request an inspection.

.2 During the Contract Administrator's inspection, a list of deficiencies will be tabulated and signed by the Contract Administrator. Correct all deficiencies.

.3 When the Contract Administrator considers that all deficiencies have been corrected and that it appears the requirements of the Contract have been performed including delivery of operation and maintenance manuals, make application for Certificate of Substantial Performance.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 National Fire Protection Association (NFPA)

.1 NFPA 13, Standard for the Installation of Sprinkler Systems.
.2 NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection.
.3 NFPA 25, Standard for Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.

.2 Underwriters Laboratories of Canada (ULC)

.1 ULC CAN-S543, Standard for Internal Lug Quick Connect Coupling for Fire Hose.

.3 Canadian Standards Association (CSA)

.1 CAN/CSA B64 Series, Back Flow Preventers for Fire Service.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings in accordance with NPFA 13, stamped and signed by a professional Contract Administrator registered or licensed to practice in the Province of Manitoba.
.2 Submit for review to Contract Administrator, Authorities Having Jurisdiction and The City's Loss Prevention Insurance Carrier for approval.

.4 Samples:

.1 Submit samples of following:

.1 Each type of sprinkler head.
.2 Signs.

1.3 CLOSEOUT SUBMITTALS

.1 Provide operation, maintenance and engineering data for incorporation into O&M manual.

.2 Manufacturer's catalog data, including specific model, type and size for:

.1 Pipe and fittings,
.2 Alarm valves,
.3 Valves, including gate, check, and globe,
.4 Water motor alarms,
.5 Sprinkler heads,
.6 Pipe hangers and supports,
.7 Pressure or flow switch,
.8 Fire department connections,
.9 Excess pressure pump,
.10 Mechanical couplings.

.3 Design Data:

.1 Calculations of sprinkler system design,
.2 Indicate type and design of each system and certify that each system has performed satisfactorily in the manner intended for not less than 12 months.

.4 Field Test Reports:

.1 Preliminary tests on piping system,

.5 Records:

.1 As-built drawings of each system.

.6 Operational and Maintenance Manuals:

.1 Provide detailed hydraulic calculations including summary sheet and Contractors Material and Test Certificate for aboveground and underground piping and other documentation for incorporation into manual in accordance with NFPA 13.
.2 Provide maintenance data for wet pipe sprinkler system.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: company or person specializing in wet pipe sprinkler systems with documented experience.
.2 Supply grooved joint couplings, fittings, valves, grooving tools ands specialties from a single manufacturer. Use date stamped castings for coupling housings, fittings, valve bodies, for quality assurance and traceability.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Provide maintenance materials in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Provide spare sprinklers and tools as required by NFPA 13.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Delivery and acceptance requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Storage and Protection:

.1 Store materials indoors in a dry location.
.2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

Part 2 PRODUCTS

2.1 DESIGN REQUIREMENTS

.1 Hydraulically design automatic wet pipe fire suppression sprinkler systems in accordance with required and advisory provisions of NFPA 13.

.2 Include with each system materials, accessories and equipment inside and outside building to provide each system complete and ready for use.

.3 Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment.

.4 Locate sprinkler heads in consistent pattern with ceiling grid, lights, and air supply diffusers.

.5 Devices and equipment for fire protection service: ULC approved for use in wet pipe sprinkler systems.

.6 Location of Sprinkler Heads:

.1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed that permitted by NFPA 13 for hazard occupancy shown on drawings.
.2 Uniformly space sprinklers on branch.

.7 Water Distribution:

.1 Make distribution uniform throughout the area in which sprinkler heads will open.
.2 Discharge from individual heads in hydraulically most remote area to be 100% of required density to meet hazard occupancy.

.8 Density of Application of Water:

.1 Size pipe to provide specified density when system is discharging specified total maximum required flow.

.9 Friction Losses:

.1 Calculate losses in piping in accordance with Hazen-Williams formula with 'C' value of 120 for steel piping, 150 for copper tubing, and 140 for cement-lined ductile-iron piping.

.10 Water Supply:

.1 Conduct flow and pressure test of water supply in vicinity of project to obtain criteria for basis of design in accordance with NFPA 13 or alternately provide information on previously performed test.

.2 The authority having jurisdiction shall be permitted to require an adjustment to the water flow test data.

2.2 PIPE, FITTINGS AND VALVES

.1 Pipe:

.1 Ferrous: to NFPA 13.

.2 Fittings and joints to NFPA 13:

.1 Ferrous: screwed, welded, flanged or roll grooved.

.1 Grooved joints designed with two ductile iron housing segments, pressure responsive gasket, and zinc-electroplated steel bolts and nuts. Cast with offsetting angle-pattern bolt pads for rigidity and visual pad-to-pad offset contact.

.2 Fittings: ULC approved for use in wet pipe sprinkler systems.

.3 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same manufacturer.

.3 Valves:

.1 ULC listed for fire protection service.

.2 Isolation Valves:

.1 Up to NPS 2:

.1 Bronze, screwed ends, OS&Y gate.

.2 NPS 2 ½ and over:

.1 Cast iron, flanged or roll grooved ends, indicating butterfly valve.

.3 Check Valves:

.1 Clear opening swing type with screwed or grooved connections.

.4 Pipe hangers:

.1 ULC listed for fire protection service in accordance with NFPA.

2.3 SPRINKLER HEADS

.1 General: to NFPA 13 and ULC listed for fire services.

.2 Provide wire head guards wherever sprinkler heads are required below ductwork and in all mechanical/machine rooms.

.3 Provide sprinkler head type suitable to meet NFPA 13 and accommodate site conditions.

2.4 RISER MANIFOLD

.1 6" diameter, listed for fire protection service and meeting requirements of Authority Having Jurisdiction.

.2 Fire protection system control module includes test and drain valve, waterflow detector, pressure gauge, flexible drain connection and adjustable pressure relief valve (175 – 310 psi/1206 – 2137 kPa adjustable set pressure).

.3 Provide butterfly isolation valve complete with integral supervisory switch.

.4 Valve Body: Cast ductile iron conforming to ASTM A536, Grade 65-45-12.

.5 Waterflow detector: Vane type waterflow detector with sealed retard, and mechanical delay adjustment. Cover includes tamper resistant security screws and tool.

.6 Acceptable Product: Victaulic Series UM Universal Manifold Assembly or Approved Equal in accordance with frontend clause B6.

2.5 SPRINKLER ZONE STATIONS

.1 Listed for fire protection service and meeting requirements of Authority Having Jurisdiction.

.2 Fire protection system control modules integrated test and drain valve, with customizable test orifice, flow switch and pressure gauge.

.3 Module Body: Cast ductile iron conforming to ASTM A536, Grade 65-45-12.

.4 Shut-off and Test/Drain Valve: Chrome plated brass ball, S 37700 brass clapper, 416SS or 410SS shafts, Delrin orifice, virgin Teflon, enhanced Teflon and EPDM rubber seals

.5 Waterflow detector: Vane type waterflow detector with sealed retard, visual switch activation, and mechanical delay adjustment. Cover includes tamper resistant security screws and tool.

.6 Acceptable Product: Victaulic Series 747M Zone Control Riser Module or Approved Equal in accordance with frontend clause B6.

2.6 SUPERVISORY SWITCHES

.1 General: to NFPA 13 and ULC listed for fire service.

.2 Valves:

.1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.

.3 Pressure or flow switch type:

.1 With normally open and normally closed contacts and supervisory capability.
.2 Provide switch with circuit opener or closer for automatic transmittal of alarm over facility fire alarm system.
.3 Connect into building fire alarm system.
.4 Connection of switch: Refer to Electrical.
.5 Alarm actuating device: mechanical diaphragm controlled retard device adjustable from [10] to [60] seconds and instantly recycle.

.4 Pressure alarm switch:

.1 With normally open and normally closed contacts and supervisory capability.

2.7 FIRE DEPARTMENT CONNECTION

.1 Provide connections approximately 1.5 m above finished grade, location as indicated.

.2 To NFPA 13 and ULC listed, Siamese or Storz type. Confirm with local Authority.

.3 Polished chrome plated exposed, and identifying fire department connection escutcheon plate.

.4 Thread specifications: compatible with local fire department.

.5 Install a 90-degree elbow with drain connection at the low point near each fire department connection to allow for system drainage to prevent freezing.

2.8 PRESSURE GAUGES

.1 ULC listed and to Section 23 05 19 Thermometers and Pressure Gauges.

.2 Maximum limit of not less than twice normal working pressure at point where installed.

2.9 PIPE SLEEVES

.1 Provide pipe sleeves where piping passes through walls and floors.

.2 Pipe sleeves to Section 23 05 05 Installation of Pipework.

2.10 ESCUTCHEONS

.1 Escutcheons to Section 23 05 05 Installation of Pipework.

2.11 INSPECTOR'S TEST CONNECTION

.1 Locate inspector's test connection at hydraulically most remote part of each system, provide test connections approximately 3 m above floor for each sprinkler system or portion of each sprinkler system equipped with alarm device.

.2 Provide test connection piping to location where discharge will be readily visible and where water may be discharged without property damage.

.3 Provide discharge orifice of same size as corresponding sprinkler orifice.

2.12 SIGNAGE

.1 Attach properly lettered and approved metal signs to each valve and alarm device to NFPA 13. At minimum, signs to be installed for the following:

- .1 Identification sign at outside alarm devices.
- .2 At Fire Department connection.
- .3 Caution sign at sprinkler alarm valve entry and at each flow switch station.
- .4 Identification of inspector's test port.

.2 Permanently fix hydraulic design data nameplates to riser of each system.

.3 Re-use existing signs where applicable.

2.13 SPARE PARTS CABINET

.1 Provide metal cabinet with extra sprinkler heads and sprinkler head wrench adjacent to each alarm valve. Number and types of extra sprinkler heads as specified in NFPA 13

2.14 BACK FLOW PREVENTION, BFP-2

.1 6" diameter, double check valve assembly backflow preventer. Listed for fire protection service and meeting requirements of Authority Having Jurisdiction.

.2 Shall be certified to NSF/ANSI/CAN 61, ASSE® Listed 1015

.3 Construction:

- .1 The main body and access cover shall be epoxy coated ductile iron (ASTM A 536)
- .2 The seat ring and check valve shall be NORYL™,

.3 The stem shall be stainless steel (ASTM A 276)
.4 The seat disc elastomers shall be EPDM.

.4 The checks shall be accessible for maintenance without removing the device from the line.

.5 BFP shall be provided with grooved end butterfly valves complete with integral supervisory switches.

.6 Acceptable Product: Zurn Wilkins model 350A-BG or Approved Equal in accordance with frontend clause B6.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTION

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install, inspect and test to acceptance in accordance with NFPA 13 and NFPA 25.

.2 Install air vents at all high points.

.3 Testing to be witnessed by Contract Administrator and Authority Having Jurisdiction. Contractor's material and test certificate for above ground piping is to be completed prior to this test.

.4 Co-ordinate any tie-ins and shutdowns with the Building Manager. Minimize any disruption to normal system operation/protection.

.5 Perform work including testing and verification in accordance with the project phasing requirements, refer to Project Manual - General Requirements.

.6 Submit Contractors Installation & Commissioning forms in accordance with NFPA 13.

.7 Pipe Installation: to NFPA 13 and Section 23 05 05 Installation of Pipework

3.3 DISINFECTION

.1 Disinfect new piping. Final water charge to sprinkler system shall be taken from The City's domestic water service.

.2 Fill piping systems with solution containing minimum of 50 parts per million of chlorine and allow solution to stand for minimum of 24 hours.

.3 Flush solution from systems with clean water until maximum residual chlorine content is not greater than 0.2 part per million or residual chlorine content of domestic water supply.

.4 Obtain at least two consecutive satisfactory bacteriological samples from piping, analyzed by certified laboratory, and submit results prior to piping being placed into service.

3.4 PAINTING

.1 To Section 21 05 01 General Provisions – Mechanical.

3.5 FIELD QUALITY CONTROL

.1 Site Test, Inspection:

.1 Perform test to determine compliance with specified requirements in presence of Authority Having Jurisdiction.

.2 Test, inspect, and approve piping before covering or concealing.

.3 Preliminary Tests:

.1 Hydrostatically test each system at 200 psig for a 2 hour period with no leakage or reduction in pressure.

.2 Flush piping with potable water in accordance with NFPA 13.

.3 Piping above suspended ceilings: tested, inspected, and approved before installation of ceilings.

.4 Test alarms and other devices.

.5 Test water flow alarms by flowing water through inspector's test connection. When tests have been completed and corrections made, submit signed and dated certificate in accordance with NFPA 13.

.4 Formal Tests and Inspections:

.1 Do not submit request for formal test and inspection until preliminary test and corrections are completed and approved.

.2 Submit written request for formal inspection at least 15 days prior to inspection date.

.3 Repeat required tests as directed.

.4 Correct defects and make additional tests until systems comply with Contract requirements.

.5 Furnish appliances, equipment, instruments, connecting devices, and personnel for tests.

.6 Authority of Jurisdiction, will witness formal tests and approve systems before they are accepted.

3.6 CLEANING

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section: 21 13 13 – Wet Pipe Sprinkler System

1.2 SCOPE OF WORK

.1 Work includes but is not specifically limited to:

- .1 Sealed Engineering calculations and design drawings for new sprinkler fire suppression system,
- .2 Verification and commissioning tests for each phase of the project,
- .3 Flow tests as required.
- .4 Installation of air-compressor for Dry Pipe Sprinkler System.
- .5 Installation of Pre-Action Dry Pipe Sprinkler System for the Vault.

1.3 DESIGN REQUIREMENTS

.1 Design automatic dry pipe fire suppression sprinkler systems in accordance with required and advisory provisions of NFPA 13.

.2 Include with each system materials, accessories and equipment inside and outside building to provide each system complete and ready for use.

.3 Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment.

.4 Locate sprinkler heads in consistent pattern within vault areas.

.5 Devices and equipment for fire protection service: ULC approved for use in dry pipe sprinkler systems.

.6 Location of Sprinkler Heads:

- .1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed that permitted by NFPA 13 for hazard occupancy shown on drawings.
- .2 Uniformly space sprinklers on branch.
- .3 Mount heads on frame/mullions of skylight.

.7 Water Distribution:

- .1 Make distribution uniform throughout the area in which sprinkler heads will open.
- .2 Discharge from individual heads in hydraulically most remote area to be 100% of required density to meet area classification.

.8 Density of Application of Water:

.1 Size pipe to provide specified density when system is discharging specified total maximum required flow.

.9 Friction Losses:

.1 Calculate losses in piping in accordance with Hazen-Williams formula with 'C' value of 120 for steel piping, 150 for copper tubing, and 140 for cement-lined ductile-iron piping.

1.4 REFERENCES

.1 ANSI/NFPA 13, Installation of Sprinkler Systems.

.2 ULC S543-M1984, Standard for Internal Lug Quick Connect Coupling for Fire Hose.

.3 CAN/CSA B64 Series of Codes; Back Flow Preventers for Fire Service.

1.5 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 21 05 01 – Submittals and in accordance with ANSI/NFPA 13, working plans and design requirements.

.2 Shop drawings shall bear the seal and be signed by a professional Contract Administrator licensed to practice by APEGM in the Province of Manitoba.

.3 Submit for review to Contract Administrator, Authorities Having Jurisdiction and The City's Loss Prevention Insurance Carrier for approval.

1.6 SAMPLES

.1 Submit samples in accordance with Section 21 05 01.

.2 Submit samples of following:

.1 Each type of sprinkler head.
.2 Signs.

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: company or person specializing in dry sprinkler systems with documented experience and approved by manufacturer.

.2 Supply grooved joint couplings, fittings, valves, grooving tools and specialties from a single manufacturer. Use date stamped castings for coupling housings, fittings, valve bodies, for quality assurance and traceability.

1.8 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in Section 21 05 01. Operation and Maintenance Manuals.

1.9 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 21 05 01.

.2 Provide spare sprinklers and tools as required by ANSI/NFPA 13.

1.10 CLOSEOUT SUBMITTALS

.1 Provide operation, maintenance and engineering data for incorporation into O&M manual.

.2 Manufacturer's catalog data, including specific model, type and size for:

.1 Pipe and fittings,
.2 Alarm valves,
.3 Valves,
.4 Water motor alarms,
.5 Sprinkler heads,
.6 Pipe hangers and supports,
.7 Pressure or flow switch,
.8 Fire department connections,
.9 Excess pressure pump,
.10 Mechanical couplings.
.11 Dry pipe system air-compressor.

.3 Design Data:

.1 Calculations of sprinkler system design,
.2 Indicate type and design of each system and certify that each system has performed satisfactorily in the manner intended for not less than 12 months,

.4 Field Test Reports:

.1 Preliminary tests on piping system,

.5 Records:

.1 As-built drawings of each system.

.6 Operational and Maintenance Manuals:

.1 Provide detailed hydraulic calculations including summary sheet and Contractors Material and Test Certificate for aboveground and underground piping and other documentation for incorporation into manual in accordance with NFPA 13.

PART 2 PRODUCTS

2.1 ENGINEERING DESIGN CRITERIA

.1 Design system for entire building in accordance with ANSI/NFPA 13, using following parameters:

.2 Hazard:

.1 As indicated on drawings.

.3 Pipe size and layout:

.1 Hydraulically design sprinkler system.
.2 Sprinkler head layout: to ANSI/NFPA 13 or as directed by authorities having jurisdiction.

.4 Water Supply:

.1 Conduct flow and pressure test of water supply in vicinity of project to obtain criteria for basis of design in accordance with ANSI/NFPA 13 or alternately provide information on previously performed test.
.2 The authority having jurisdiction shall be permitted to require an adjustment to the water flow test data.

2.2 PIPE, FITTINGS AND VALVES

.1 Pipe:

.1 Ferrous: to ANSI/NFPA 13.

.2 Fittings and joints to ANSI/NFPA 13:

.1 Ferrous: screwed, welded, flanged or roll grooved.

.1 Grooved joints designed with two ductile iron housing segments, pressure responsive gasket, and zinc-electroplated steel bolts and nuts. Cast with offsetting angle-pattern bolt pads for rigidity and visual pad-to-pad offset contact.

.2 Fittings: ULC approved for use in wet pipe sprinkler systems.

.3 Valves:

.1 ULC listed for fire protection service.
.2 Up to NPS 2: bronze, screwed ends, OS&Y gate.
.3 NPS 2 ½ and over: cast iron, flanged or roll grooved ends, indicating butterfly valve.
.4 Swing check valves
.5 Ball drip.

.4 Pipe hangers:

.1 ULC listed for fire protection services.

2.3 SPRINKLER HEADS

.1 General: to ANSI/NFPA 13 and ULC listed for fire services.

.2 Provide head guards wherever sprinkler heads are required below ductwork and in all mechanical/machine rooms.

.3 Provide sprinkler head type suitable to meet NFPA 13 and accommodate site conditions.

2.4 PRE-ACTION ALARM VALVE

.1 ULC listed.

.2 Cast or ductile iron, flanged or grooved end type, sized to suit water main.

.3 Components:

- .1 Accelerator.
- .2 Air maintenance device with low pressure alarm.
- .3 Alarm pressure switch with supervisory capability.
- .4 Test valve and associated piping.
- .5 Drain valve.
- .6 Electrical tripping device.
- .7 Shut off valve – OS & Y with tamper-proof device wired back to fire alarm panel.

.4 Provide valve complete with internal components that are replaceable without removing valve from installed position.

2.5 COMPRESSED AIR SUPPLY

.1 Automatic Air Compressor.

.2 ULC listed.

.3 Capacity:

- .1 To restore normal air pressure in system with 30 minutes.
- .2 To provide air pressure in accordance with instruction sheet furnished with dry pipe valve.
- .3 Piping: ferrous, NPS ¾” screwed joints and fittings, to NFPA 13.
- .4 Provide automatic air compressor complete with vibration isolation.

2.6 ESCUTCHEON PLATES

.1 Provide one-piece type metal plates for piping passing through walls, floors, and ceilings in exposed spaces.

.2 Provide polished stainless-steel plates in finished spaces.

.3 Provide paint finish on metal plates in unfinished spaces.

2.7 PRESSURE GAUGES

.1 As required by code and where indicated.

.2 Maximum limit of not less than twice normal working pressure at point where installed.

2.8 RELIEF VALVE

.1 ULC Listed.

2.9 SPARE PARTS CABINET

.1 For storage of maintenance materials, spare sprinkler heads and special tools.

.2 Construct to sprinkler head manufacturers standard.

.3 Install within mechanical room.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install, inspect and test to acceptance in accordance with ANSI/NFPA 13 and FC 403.

.2 Testing to be witnessed by Contract Administrator and authority having jurisdiction. Contractor's material and test certificate for above ground piping is to be completed prior to this test.

.3 Install spare parts cabinet as indicated.

.4 Pressure gages:

.1 Location:

.1 On water side and air side of dry pipe valve.

.2 At air receiver.

.3 In each independent pipe from air supply to dry pipe valve.

.4 At exhausters and accelerators.

.2 Install to permit removal.

.3 Locate so as not subjected to freezing.

.5 Valve identification:

.1 Identify drain valve, by-pass valves and main shut-off valve and all auxiliary valves.

.6 Submit Contractors Installation & Commissioning forms in accordance with NFPA 13.

3.3 FIELD QUALITY CONTROL

.1 Site Test, Inspection:

.1 Perform test to determine compliance with specified requirements in presence of AHJ.

.2 Test, inspect, and approve piping before covering or concealing.

.3 Preliminary Tests:

.1 Hydrostatically test each system at 200 psig for a 2 hour period with no leakage or reduction in pressure.

.2 Flush piping with potable water in accordance with NFPA 13.

.3 Piping above suspended ceilings: tested, inspected, and approved before installation of ceilings.

.4 Test alarms and other devices.

.5 Test water flow alarms by flowing water through inspector's test connection. When tests have been completed and corrections made, submit signed and dated certificate in accordance with NFPA 13.

.4 Formal Tests and Inspections:

.1 Do not submit request for formal test and inspection until preliminary test and corrections are completed and approved.

.2 Submit written request for formal inspection at least 15 days prior to inspection date.

.3 Repeat required tests as directed.

.4 Correct defects and make additional tests until systems comply with Contract requirements.

.5 Furnish appliances, equipment, instruments, connecting devices, and personnel for tests.

.6 Authority of Jurisdiction, will witness formal tests and approve systems before they are accepted.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for plumbing pumps.

1.2 REFERENCES

.1 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.
.2 Indicate dimensions, construction details and materials for specified items.
.3 Submit WHMIS MSDS; indicate VOC's for adhesive and solvents during application and curing.

.3 Shop Drawings:

.1 Submit shop drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions, and construction and assembly details.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Manufacturers' Field Reports: manufacturers' field reports specified.

.7 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 21 05 01 General Provisions – Mechanical, include:

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.
.2 Details of operation, servicing and maintenance.
.3 Recommended spare parts list.

1.4 QUALITY ASSURANCE

.1 Pre-Installation Meetings:

.1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations in accordance with Section 21 05 01 General Provisions – Mechanical.

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building sub-trades.

.4 Review manufacturer's installation instructions and warranty requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Store and manage hazardous materials in accordance with Section 21 05 01 General Provisions - Mechanical.

Part 2 PRODUCTS

2.1 DOMESTIC HOT WATER RECIRCULATION PUMP, RP-01

.1 General:

.1 Automatic Operation
.2 LED Display
.3 6’ Line Cord
.4 Field Replaceable Cartridge
.5 Integral Flow Check

.2 Materials of Construction:

.1	Casting (Volute):	Stainless Steel
.2	Stator Housing:	Steel
.3	Cartridge:	Stainless Steel
.4	Impeller:	Non-Metallic
.5	Shaft:	Ceramic
.6	Bearings:	Carbon
.7	O-Ring & Gaskets:	EPDM

.3 Integral Flow Check:

.1	Body, Plunger:	Acetal
.2	O-Ring Seals:	EPDM
.3	Spring:	Stainless Steel

.4 Performance:

.1	Flow:	10 usgpm
.2	Head:	10 ft of TDH
.3	Power:	1/25 HP
.4	Electrical:	115 V / 1 ph / 60 Hz

.5 Approved Product:

.1 Taco 008-IQSF6-IFC or Approved Equal in accordance with frontend clause B6.

.6 Approved Equal:

.1 Armstrong, Bell & Gossett, Grundfos, Goulds, Wilo equivalent to meet or exceed specified product.

2.2 CONDENSATE REMOVAL PUMP

.1 Provide condensate removal pumps for corridor mounted fan coils.

.2 General:

.1 Fully automatic: start, stop, safety switch
.2 Operating point: 4 m: 70 l/h
.3 1/30 HP motor
.4 ABS tank, motor cover, and volute
.5 Stainless steel shaft
.6 Check valve outlet: 9.5 mm, for 9.5 mm ID tubing
.7 1.0 l tank capacity
.8 Removable 9.5 mm barbed check valve
.9 Thermally protected motor

.3 Performance:

.1 Capacity: 273 LPH @ 0.31 m
.2 Shut Off: 4.3 m
.3 Liquid Temperature: 50°C
.4 Discharge: 9.5 mm
.5 Impeller: Glass-filled polypropylene
.6 Electrical: 115V, 60Hz, 1.5 amps, 93 watts
.7 Operation: Automatic

.4 Approved Product:

.1 Little Giant VCC-20ULS or Approved Equal in accordance with frontend clause B6.

2.3 SANITARY LIFT STATION SUMP PIT

.1 Work listing described within specification to be in coordination with scope of work items shown and described on the drawings.

.2 Pre-Assembled Fibreglass Basin, Complete With:

.1 24 inch diameter by 60 inch depth (field confirm),
.2 Anti Flotation Flange,
.3 Factory Installed Coupling Studs for Quick Disconnect,
.4 Vent Connection,

.5 4" FG Inlet Hub and Grommet,
.6 Lifting lugs.

.3 Approved Product: Liberty Pumps Accessory Basin

2.4 SANITARY LIFT STATION

.1 General:

.1 The Contractor shall provide labor, material, equipment, and incidentals required to provide (1) centrifugal pump as specified herein. The pump models covered in this specification are ELV Series single phase pumps. The pump furnished for this application shall be model ELV290 as manufactured by Liberty pumps.
.2 The pumping system shall be ULc, AMSE A17.1 and CSA certified.

.2 Features:

.1 Complete packaged system,
.2 Heavy-duty 3/4 hp cast iron sump pump,
.3 Oil resistant cord,
.4 1-1/2" discharge,
.5 OilTector Control,
.6 Remote Alarm with auxiliary contacts for connection to building automation or SCADA system, 24 volt AC/DC, 100 mA max switching,
.7 Easy clamp-mount pre-set level sensor holder with plug-in ready wiring,
.8 Control panel with separate pump and control circuits- Nema 1 enclosure. Height 10" x Width 7.5" x Depth 5.5",
.9 Power on, Pump Run, High water and High oil lights.

.3 Operating Conditions:

.1 Each submersible pump shall be rated for 3/4hp, voltage to be 115 or 230 refer to electrical drawings for confirmation. The unit shall produce 50 G.P.M. at 25 feet of total dynamic head. The submersible pump shall be capable of handling water with ¾" solid handling capability. The submersible pump shall have a shut-off head of 47 feet and a maximum flow of 78 GPM @ 5 feet of total dynamic head. The pump shall be controlled with: The manual pump is connected to a control which has the ability to prevent oil from being pumped from the vault. This same control unit will activate an alarm when an oil "film" is detected or when a high-water condition exits. The system will continue to monitor and remove water from the vault even if an oil condition is detected.

.4 Construction:

.1 Each centrifugal sump pump shall be equal to the CSA Certified ELV-Series pumps. The castings shall be constructed of class 25 cast iron. The motor housing shall be oil filled to dissipate heat. Air filled motors shall not be considered equal since they do not properly dissipate heat from the motor. All mating parts shall be machined and sealed with a Buna-N o-ring. All

fasteners exposed to the liquid shall be stainless steel. The motor shall be protected on the top side with sealed cord entry plate with molded pins to conduct electricity eliminating the ability of water to enter internally through the cord. The motor shall be protected on the lower side with a unitized ceramic/carbon seal with stainless steel housings and spring or engineered double lip seal with stainless steel springs. The pump shall be furnished with stainless steel handle.

.5 Electrical Power Cord:

.1 The submersible pump shall be supplied with 50 feet of multiconductor power cord. It shall be cord type YELLOW UL 16-3 SJEOOW 300V 105°C, capable of continued exposure to the pumped liquid. The power cord shall be sized for the rated full load amps of the pump in accordance with the National Electric Code. The power cable shall not enter the motor housing directly but will conduct electricity to the motor by means of a water tight compression fitting cord plate assembly, with molded pins to conduct electricity. This will eliminate the ability of water to enter internally through the cord, by means of a damaged or wicking cord.

.6 Motors:

.1 Single phase motors shall be oil filled, permanent split capacitor, class B insulated NEMA B design, rated for continuous duty. At maximum load the winding temperature shall not exceed 130 degrees C unsubmerged. Since air filled motors are not capable of dissipating heat, they shall not be considered equal. The pump motor shall have an integral thermal overload switch in the windings for protecting the motor. The capacitor circuit shall be mounted internally in the pump.

.7 Bearings and Shaft:

.1 An upper sleeve and lower ball bearing shall be required. The lower ball bearing shall be a single ball / race type bearing. Both bearings shall be permanently lubricated by the oil, which fills the motor housing. The motor shaft shall be made of 300 or 400 series stainless steel.

.8 Seals

.1 The pump shall have a unitized carbon / ceramic seal with stainless steel housings and spring, or engineered double lip seal with stainless steel springs. The motor plate / housing interface shall be sealed with a Buna-N o-ring.

.9 Impeller:

.1 The impeller shall be vortex style made of an engineered polymer, with pump out vanes on the back shroud to keep debris away from the seal area. It shall be threaded to the motor shaft.

.10 Controls:

.1 The control unit has three probes and a float ball switch. The pump will activate when the middle probe contacts water, and will remain on until the first, longest probe no longer is in contact with water. A high-water alarm is activated when third or shortest probe contacts water. The system will ignore a small film of oil, however larger volumes of oil will be detected when the alarm probe does not detect water and the float ball activates. The system will continue to operates, removing water not oil from the vault even when oil has been detected.

.11 Paint:

.1 The exterior of the casting shall be protected with powder coat paint.

.12 Support:

.1 The pump shall have cast iron support legs, enabling it to be a free-standing unit.

.13 Testing:

.1 The pump shall have a ground continuity check and the motor chamber shall be Hi-potted to test for electrical integrity, moisture content and insulation defects. The motor and volute housing shall be pressurized, and an air leak decay test is performed to ensure integrity of the motor housing. The pump shall be run, voltage current monitored, and the tester checks for noise or other malfunction.

.14 Quality Control:

.1 The pump shall be manufactured in an ISO 9001 certified Facility.

.15 Warranty:

.1 Standard limited warranty shall be 3 years.

.16 Acceptable Product: Liberty Pumps ELV-Series ELV290 System with OilTector Control or Approved Equal in accordance with frontend clause B6.

2.5 SUBMERSIBLE SUMP PUMP (PRE-ASSEMBLED PACKAGE)

.1 General:

.1 The Contractor shall provide labor, material, equipment, and incidentals required to provide two submersible solids handling effluent pumps as specified herein.

.2 The pumping system shall be ULc and CSA certified.

.2 Basin:

.1 Poly structural foam deluxe basin.
.2 Solid steel cover with 2” top discharge, 2” vent.
.3 Capacity: 36”x36” basin.
.4 Inlet hub: 4” (100 mm).

.3 Discharge Piping:

.1 2” (50 mm) Schedule 80 PVC

.4 Control Panel:

.1 NEMA 4X duplex panel, complete with:

.1 ULc labeled
.2 Fully Hinged Inner Door
.3 Pump and Control Breakers, Resettable From Inner Door
.4 Four Float Logic
.5 Dry Contact for Remote High-Water Alarm
.6 120 volt control circuit/transformer
.7 Pump Run Lights
.8 HOA Switches
.9 Alarm Test-Off-Auto Switch
.10 Visual High Water Alarm Light
.11 Audible High Water Alarm Buzzer

.5 Submersible Solids Handling Effluent Pump:

.1 Durable Epoxy Coated Cast Iron Construction
.2 0.4 HP, 120/1/60 Thermal Overload Protected Motor
.3 Non-Clogging Vortex Impeller Design
.4 Mechanical Shaft Seal
.5 20 ft Power Cable
.6 ¾” Solids Handling Capability
.7 1 ½” NPT Discharge
.8 Capacity: 40 USGPM @ 20 ft TDH

.6 Accessories:

.1 Two (2) 2” PVC combination check valve, ball valve and union.
.2 Four (4) float switches.

.7 Controls:

.1 The pumps shall be controlled with a NEMA 4X outdoor duplex control panel with four float switches and a high-water alarm.

.8 Acceptable Product:

.1 Zoeller 947 Duplex Effluent Pre-Assembled Package with two (2) Zoeller N152 pumps and ECP-10-1041 Control Panel or Approved Equal in accordance with frontend clause B6.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

.1 Install in accordance with Manitoba Plumbing Code and local authority having jurisdiction.

.2 Make piping and electrical connections to pump and motor assembly and controls as indicated.

.3 Ensure pump and motor assembly do not support piping.

.4 Align vertical pit mounted pump assembly after mounting and secure cover plate.

.5 Install in accordance with manufacturer's instructions and as specified.

3.3 FIELD QUALITY CONTROL

.1 Site Tests/Inspections:

- .1 Check power supply.
- .2 Check starter protective devices.

.2 Start-up, check for proper and safe operation.

.3 Check settings and operation of hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.

.4 Adjust flow from water-cooled bearings.

.5 Adjust impeller shaft stuffing boxes, packing glands.

3.4 START-UP

.1 General:

- .1 Check power supply.
- .2 Check starter O/L heater sizes.
- .3 Start pumps, check impeller rotation.
- .4 Check for safe and proper operation.
- .5 Check settings, operation of operating, limit, safety controls, over-temperature, audible/visual alarms, other protective devices.
- .6 Test operation of hand-off-auto switch.

.7 Test operation of alternator.
.8 Adjust leakage through water-cooled bearings.
.9 Adjust shaft stuffing boxes.
.10 Adjust leakage flow rate from pump shaft stuffing boxes to manufacturer's recommendations.
.11 Check base for free-floating, no obstructions under base.
.12 Run-in pumps for 12 continuous hours.
.13 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.
.14 Adjust alignment of piping and conduit to ensure full flexibility.
.15 Eliminate causes of cavitation, flashing, air entrainment.
.16 Measure pressure drop across strainer when clean and with flow rates as finally set.
.17 Replace seals if pump used to degrease system or if pump used for temporary heat.
.18 Verify lubricating oil levels

3.5 TRAINING

.1 In accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Demonstrate full compliance with Design Criteria.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American National Standards Institute (ANSI) / American Society of Mechanical Engineers International (ASME)

- .1 ANSI/ASME B16.15, Cast Bronze Threaded Fittings, Classes 125 and 250.
- .2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
- .3 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- .4 ANSI/ASME B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.

.2 ASTM International Inc.

- .1 ASTM A 307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 ASTM A 536, Standard Specification for Ductile Iron Castings.
- .3 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .4 ASTM B 88M, Standard Specification for Seamless Copper Water Tube (Metric).

.3 American National Standards Institute (ANSI) /American Water Works Association (AWWA)

- .1 ANSI/AWWA C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.4 American National Standards Institute (ANSI) / American Welding Society (AWS)

- .1 ANSI/AWS A5.8, Specification for Filler Metals for Brazing and Braze Welding.
- .2 ANSI/AWS B2.2 / B2.2M, Specification for Brazing Procedure and Performance Qualification.

.5 Canadian Standards Association (CSA International)

- .1 CSA B125.1, Plumbing Supply Fittings
- .2 CSA BB125.3, Plumbing Fittings
- .3 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.

.6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

- .1 Material Safety Data Sheets (MSDS).

.7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).

- .1 MSS-SP-67, Butterfly Valves.
- .2 MSS-SP-70, Gray Iron Gate Valves, Flanged and Threaded Ends.
- .3 MSS-SP-71, Gray Iron Swing Check Valves, Flanged and Threaded Ends.

.4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.

.8 National Research Council (NRC) / Institute for Research in Construction (IRC)

.1 National Plumbing Code of Canada (NPC).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Sections 21 05 01 General Provisions – Mechanical.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 21 05 01 General Provisions – Mechanical.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Place materials defined as hazardous or toxic in designated containers.

.2 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

.3 Refer to Section 21 05 01 General Provisions – Mechanical.

Part 2 PRODUCTS

2.1 PIPING

.1 Domestic hot, cold and recirculation systems within building.

.1 NPS 2 ½" (63 mm) and smaller:

.1 Above ground: copper tube, hard drawn, Type L: to ASTM B 88M.

.2 Buried or embedded: copper tube, soft annealed, Type K: to ASTM B88M, in long lengths and with no buried joints.

.2 NPS 3" (75 mm) and larger:

.1 Above ground, buried or embedded: 316L, 10S stainless steel: to ASTM A312 Grade TP316L

2.2 FITTINGS

.1 General:

.1 All fittings to be lead free to ASME A112.18.1 / CSA B125.1 and CSA B125.3

.2 NPS 2 ½" (63 mm) and smaller:

.1 Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24.

.2 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.
.3 Cast copper, solder type: to ANSI/ASME B16.18.
.4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
.5 Wrought copper and copper alloy, brazed type: to ANSI/ASME B16.50.

.3 NPS 3" (75 mm) and larger:

.1 316L stainless steel, grooved: to ASTM A312 Grade TP316L, ANSI/ASME B16.9 and roll grooved to CSA B242.

2.3 JOINTS

.1 Under 2" (50 mm) diameter:

.1 Solder: 95/5 tin copper alloy lead free.
.2 Threaded: Teflon tape.

.2 2" (50 mm) to 2 ½" (63 mm) diameter:

.1 Brazed, silver solder.

.3 3" (75 mm) diameter and larger:

.1 Grooved couplings:

.1 Housing: Ductile iron conforming to ASTM A536, Grade 65-45-12.

.2 Gasket: Grade "P" Fluoroelastomer Blend, specifically formulated for compatibility with potable water systems and optimized for improved resistance to chlorine, chloramine and other typical potable water disinfectants.

.3 Bolts, nuts, hex head and washers: Carbon steel oval neck track bolts meeting the mechanical property requirements of ASTM A449. Carbon steel hex nuts meeting the mechanical property requirements of ASTM A563 Grade B. Track bolts and hex nuts are zinc electroplated per ASTM B633 ZN/FE5, finish Type III.

.4 Acceptable Product: Victaulic Flexible Coupling Style 877N or Approved Equal in accordance with frontend clause B6.

.4 Dielectric connections between dissimilar metals: dielectric flanges, no dielectric couplings permitted.

2.4 BALL VALVES

.1 NPS 2" (50 mm) and under, soldered:

.1 Forged two-piece construction, lead free, full port brass body, chrome plated brass ball, PTFE adjustable packing gland, PTFE seat, steel lever handle, with solder ends.
.2 To ANSI/ASME B16.22, Class 150.
.3 NSF/ANSI 61 compliant for potable water systems.
.4 Acceptable Product: M.A. Stewart B-4-LF or Approved Equal in accordance with frontend clause B6.

.2 NPS 2” (50 mm) and under, screwed:

.1 Forged two-piece construction, lead free, full port brass body, chrome plated brass ball, PTFE adjustable packing gland, PTFE seat, steel lever handle, with NPT ends.
.2 To ANSI/ASME B16.22, Class 150.
.3 NSF/ANSI 61 compliant for potable water systems.
.4 Acceptable Product: M.A. Stewart B-3-LF or Approved Equal in accordance with frontend clause B6.

2.5 GLOBE VALVES

.1 NPS 2” (50 mm) and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, lead free body and disc, screwed over bonnet.
.2 Acceptable Product: Kitz Fig. 812 or Approved Equal in accordance with frontend clause B6.

.2 NPS 2” (50 mm) and under, screwed:

.1 To MSS-SP-80, Class 125, 1 MPa, lead free body and disc, screwed over bonnet.
.2 Acceptable Product: Kitz Fig. 811 or Approved Equal in accordance with frontend clause B6.

2.6 SWING CHECK VALVES

.1 NPS 2” (50 mm) and under, soldered:

.1 To MSS-SP-80, Class 125, 125 psi (860 kPa), lead free body, bronze swing disc, screw in cap, regrindable seat.
.2 Acceptable Product: Kitz Fig. 823 or Approved Equal in accordance with frontend clause B6.

.2 NPS 2” (50 mm) and under, screwed:

.1 To MSS-SP-80, Class 125, 125 psi (860 kPa), lead free body, bronze swing disc, screw in cap, regrindable seat.
.2 Acceptable Product: Kitz Fig. 822 or Approved Equal in accordance with frontend clause B6.

.3 NPS 2 1/2 (63 mm) and over, flanged:

.1 Class 125, 125 psi (860 kPa), ductile iron body, flat flange faces, renewable seat, ductile iron disc, bolted cap.
.2 Acceptable Product: M.A. Stewart W30-A-RD-FF or Approved Equal in accordance with frontend clause B6.

2.7 BUTTERFLY VALVES

.1 NPS 2-1/2 (63 mm) and over:

.1 200 psig (1379 kPa), bi-directional, drop tight, lug body, stainless steel body, stainless steel disc, stainless steel stem, EPDM seat, PTFE/graphite bushing, EPDM O-ring, indexed, spring locking lever handle.

.2 Approved Products: M.A. Stewart L-S-5-S-E-LH or Approved Equal in accordance with frontend clause B6

Part 3 EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install in accordance with Manitoba Plumbing Code and local authority having jurisdiction.

.2 Assemble piping using fittings manufactured to ANSI standards.

.3 Install DCW piping below and away from DHW and DHWR and other hot piping so as to maintain temperature of cold water as low as possible.

.4 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

.5 Buried tubing:

.1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.

.2 Bend tubing without crimping or constriction. Minimize use of fittings.

.6 Brazing Procedure:

.1 To ANSI/AWS A5.8 and B2.2.

.2 Bleed dry nitrogen into pipe during brazing.

3.3 VALVES

.1 Isolate equipment, fixtures and branches with ball valves located in a concealed, serviceable location.

.2 Provide fixtures stops for all fixtures.

.3 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

3.4 PRESSURE TESTS

.1 Refer to Section 21 05 01 General Provisions – Mechanical.

3.5 FLUSHING AND CLEANING

.1 Flush entire system for 8 hours. Ensure outlets flushed for 2 hours. Let stand for 24 hours, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean copper to Provincial potable water guidelines. Let system flush for additional 2 hours, then draw off another sample for testing.

3.6 PRE-START-UP INSPECTIONS

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

.3 Ensure that pressure booster systems are operating properly.

.4 Ensure that air chambers, expansion compensators are installed properly.

3.7 DISINFECTION

.1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction and approval of Contract Administrator.

.2 Upon completion, provide laboratory test reports on water quality for Contract Administrator Representative approval.

3.8 START-UP

.1 Timing: start up after:

.1 Pressure tests have been completed.
.2 Disinfection procedures have been completed.
.3 Certificate of static completion has been issued.
.4 Water treatment systems operational.

.2 Provide continuous supervision during start-up.

.3 Start-up procedures:

.1 Establish circulation and ensure that air is eliminated.
.2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
.3 Bring DHW storage tank up to design temperature slowly.

.4 Monitor DHW and DHWR piping systems for freedom of movement, pipe expansion as designed.

.5 Check control, limit, safety devices for normal and safe operation.

.6 Rectify start-up deficiencies.

3.9 PERFORMANCE VERIFICATION

.1 Scheduling:

.1 Verify system performance after pressure and leakage tests and disinfection are completed, and Certificate of Completion has been issued by authority having jurisdiction.

.2 Procedures:

.1 Verify that flow rate and pressure meet Design Criteria.

.2 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.

.3 Verify performance of temperature controls.

.4 Verify compliance with safety and health requirements.

.5 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.

.6 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.

.3 Reports:

.1 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

3.10 CLEANING

.1 Clean in accordance with Section 21 05 01 General Provisions – Mechanical.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 ASTM International Inc.

- .1 ASTM D 2564, Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
- .2 ASTM D 3311, Standard Specification for Drain, Waste, and Vent (DWV) Plastic Fitting Patterns
- .3 ASTM D 4101, Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials
- .4 ASTM F1412, Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems

.2 Canadian Standards Association (CSA International)

- .1 CAN/CSA Series B1800, Thermoplastic Nonpressure Pipe Compendium.
- .2 CAN/CSA B137.3 Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.

.3 Green Seal Environmental Standards (GSES)

- .1 Standard GS-36, Commercial Adhesives.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

- .1 Material Safety Data Sheets

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals: in accordance with Section 21 05 01 – General Provisions - Mechanical.

.2 Product Data:

- .1 Provide manufacturer's printed product literature and datasheets for adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Store at temperatures and conditions recommended by the manufacturer.

Part 2 PRODUCTS

2.1 PIPING AND FITTINGS

.1 Drainage, waste and vent piping within building (non-plenum rated):

- .1 Above ground and buried: PVC-DWV to CAN/CSA B1800.
- .2 Approved Product: IPEX System 15

.2 Drainage, waste and vent piping within building (plenum rated):

- .1 Certified to CAN/CSA B1800; tested and listed in accordance with CAN/UL S102.2
- .2 Flame spread rating shall be not more than 25
- .3 Smoke developed classification not exceeding 50
- .4 Joints: solvent cement to manufacturer's standard and/or MJ couplings to manufacturer's standard
- .5 Approved Product: IPEX System XFR or Approved Equal in accordance with frontend clause B6

.3 Sump Pump discharge Piping:

- .1 Schedule 80 PVC to CAN/CSA B137.3

.4 Acid Waste Piping:

- .1 Polypropylene conforming to ASTM D4101.Manufactured to the dimensions and tolerances of ASTM F1412 from fire retardant material in 10 ft lengths. Pipe will be cylindrical and straight.
- .2 Fittings will be manufactured to schedule 40 dimensions per ASTM F1412 and will be made of fire retardant polypropylene. Fitting layouts will conform to ASTM D3311 and ASTM F1412. The polypropylene material will conform to ASTM D4101.
- .3 Acceptable Product: Orion Blueline acid waste piping.

2.2 JOINTS

.1 Solvent weld for PVC: to ASTM D 2564.

.2 Acid Waste Piping: Socket fusion. All fittings are to be socket end. All joints are to be fused to produce a hermetically sealed joint. Joints and joining procedures will conform to ASTM 2657, Technique 1.

2.3 CEMENT

.1 To be from the approved manufacturer.

.2 To be compatible with piping material.

Part 3 EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install in accordance with Manitoba Plumbing Code and local authority having jurisdiction.

3.3 TESTING

.1 Refer to Section 21 05 01 General Provisions – Mechanical.

.2 Perform ball tests to Manitoba Plumbing Code to verify grade and confirm no obstruction exist.

3.4 PERFORMANCE VERIFICATION

.1 Cleanouts:

.1 Ensure accessible and that access doors are correctly located.
.2 Open, cover with linseed oil and re-seal.
.3 Verify cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Storm water drainage:

.1 Verify domes are secure.
.2 Ensure weirs are correctly sized and installed correctly.
.3 Verify provisions for movement of roof system.

.4 Ensure that fixtures are properly anchored, connected to system and effectively vented.

.5 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 15 ft (4.5 m), whichever is less.

3.5 CLEANING

.1 Clean in accordance with Section 21 05 01 General Provisions – Mechanical.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American National Standards Institute/Canadian Standards Association (ANSI/CSA)

.1 ANSI Z21.10.1/CSA 4.1, Gas Water Heaters - Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu Per Hour or Less.
.2 ANSI Z21.10.1A/CSA 4.1A, Addenda 1 to ANSI Z21.10.1/CSA 4.1, Gas Water Heaters Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu Per Hour or Less.
.3 ANSI Z21.10.1b/CSA 4.1b, Addenda 2 to ANSI Z21.10.1/CSA 4.1, Gas Water Heaters - Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu Per Hour or Less.
.4 ANSI Z21.10.3A/CSA 4.3, Gas Water Heaters - Volume III - Storage Water Heaters, with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous.

.2 Canadian Standards Association (CSA International)

.1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.
.2 CAN/CSA B139, Installation Code for Oil Burning Equipment.
.3 CAN/CSA B140, Oil Burning Equipment: General Requirements
.4 CAN/CSA B149.1, Natural Gas and Propane Installation Code.
.5 CAN/CSA B149.2, Propane Storage and Handling Code.
.6 CSA B140.12, Oil-Burning Equipment: Service Water Heaters for Domestic Hot Water, Space Heating, and Swimming Pools
.7 CAN/CSA C22.2 No.110, Construction and Test of Electric Storage Tank Water Heaters.
.8 CAN/CSA C191, Performance of Electric Storage Tank Water Heaters for Household Service.
.9 CAN/CSA C309-M90, Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for domestic water heater, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance and engineering data for incorporation into manual specified in Section 21 05 01 General Provisions – Mechanical.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

1.5 WARRANTY

.1 Contractor hereby warrants domestic water heaters in accordance with The City of Winnipeg General Conditions For Construction, but for number of years specified for each product.

Part 2 PRODUCTS

2.1 DOMESTIC HOT WATER TANK, DHWT-1:

.1 Tanks shall have 150 psi working pressure and be equipped with extruded high-density anode.

.2 All internal surfaces of the heater(s) exposed to water shall be glass lined with an alkaline borosilicate composition that has been fused-to-steel by firing at a temperature range of 1400°F to 1600°F.

.3 Electric heating elements shall be low watt density. Each element shall be controlled by an individually mounted thermostat and high temperature cut-off switch.

.4 All internal circuits shall be fused.

.5 The outer jacket shall be of baked enamel finish and shall be provided with full size control compartment for performance of service and maintenance through hinged front panel and shall enclose the tank with foam insulation.

.6 Electrical junction box with heavy duty terminal block shall be provided.

.7 The drain valve shall be located in the front for ease of servicing.

.8 Heater tank shall have a three-year limited warranty as outlined in the written warranty.

.9 Performance & Acceptable Product:

.1 Refer to schedule on drawings.

2.2 TRIM AND INSTRUMENTATION

.1 Drain valve: NPS ¾" (19 mm) with hose end.

.2 Provide flex connector braided-stainless steel water connections and compression nuts.

.3 Supply and install ASME rated safety relief valve and drain pipe to drain pan or nearest floor drain.

.4 Provide heat traps on hot and cold domestic water piping connections to hot water storage tank.

Part 3 EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install in accordance with manufacturer's recommendations and authority having jurisdiction.

.2 Provide structural steel for instantaneous heaters.

.3 Provide insulation between tank and supports

.4 Install oil burning domestic water heaters in accordance with CAN/CSA B139.

.5 Install natural gas and propane fired domestic water heaters in accordance with CAN/CSA B149.1.

3.3 CLEANING

.1 Clean in accordance with Section 21 05 01 General Provisions - Mechanical.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for plumbing specialties and accessories.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM).

.1 ASTM A 126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
.2 ASTM B 62, Specification for Composition Bronze or Ounce Metal Castings.

.2 American Water Works Association (AWWA).

.1 AWWA C700, Cold Water Meters-Displacement Type, Bronze Main Case.
.2 AWWA C701, Cold Water Meters-Turbine Type for Customer Service.
.3 AWWA C702, Cold Water Meters-Compound Type.

.3 Canadian Standards Association (CSA International).

.1 CSA-B64 Series, Backflow Preventers and Vacuum Breakers.
.2 CSA-B79, Floor, Area and Shower Drains, and Cleanouts for Residential Construction.
.3 CSA-B356, Water Pressure Reducing Valves for Domestic Water Supply Systems.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

.5 The Plumbing and Drainage Institute (PDI).

.1 PDI-G101, Testing and Rating Procedure for Hydro Mechanical Grease Interceptors with Appendix of Installation and Maintenance.
.2 PDI-WH201, Water Hammer Arresters.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.
.2 Indicate dimensions, construction details and materials for specified items.
.3 Submit WHMIS MSDS in accordance with Section 21 05 01 General Provisions – Mechanical. Indicate VOC's for adhesive and solvents during application and curing.

.3 Shop Drawings:

.1 Submit shop drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions construction and assembly details.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Manufacturers' Field Reports: manufacturers' field reports specified.

.7 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 21 05 01 General Provisions – Mechanical, include:

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.
.2 Details of operation, servicing and maintenance.
.3 Recommended spare parts list.

1.4 QUALITY ASSURANCE

.1 Pre-Installation Meetings:

.1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations in accordance with Section 21 05 01 – General Provisions - Mechanical.

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building sub-trades.

.4 Review manufacturer's installation instructions and warranty requirements.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 21 05 01 General Provisions – Mechanical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Store and manage hazardous materials in accordance with Section 21 05 01 General Provisions – Mechanical.

Part 2 PRODUCTS

2.1 FLOOR DRAINS

.1 Floor drains: to CSA B79.

.2 Floor Drains:

.1 FD-1: Floor drain

.1 9” (229 mm) round, epoxy coated floor cast iron floor drain with anchor flange, reversible clamping collar with primary & secondary weepholes, adjustable heel proof nickel bronze strainer with surface membrane clamp and no hub outlet.

.2 Floor drain for 3” (75 mm) diameter pipe, complete with trap primer tapping.

.3 Acceptable product: Watts FD-100-FC or Approved Equal in accordance with frontend clause B6.

.2 FD-2: Floor drain with funnel

.1 9” (229 mm) round, epoxy coated floor cast iron floor drain with anchor flange, reversible clamping collar with primary & secondary weepholes, adjustable heel proof nickel bronze strainer with surface membrane clamp and no hub outlet.

.2 Floor drain for 3” (75 mm) diameter pipe, complete with trap primer tapping and 4” (102 mm) x9” (229 mm) oval nickel bronze funnel.

.3 Acceptable product: Watts FD-100-FC or Approved Equal in accordance with frontend clause B6.

2.2 ROOF DRAIN, RD-1:

.1 3” (75 mm) diameter outlet, 15” (381 mm) diameter roof drain dome, dura-coated cast iron body with combination membrane flashing clamp/gravel guard and low silhouette poly-dome.

.2 Provide aluminium dome option.

.3 Acceptable Product: Zurn model ZA100 or Approved Equal in accordance with frontend clause B6.

2.3 DOWNSPOUT NOZZLE

.1 Cast nickel bronze downspout nozzle with anchor flange, countersunk mounting holes, and IPS threaded (standard), no hub, or push-on connection. Provide optional stainless steel bird screen.

.2 Acceptable Product: Watts RD-940 or Approved Equal in accordance with frontend clause B6.

2.4 CLEANOUTS

.1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.

.2 Access Covers:

.1 Wall Access: face or wall type, stainless steel and round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.

.2 Floor Access: round cast iron body and frame with adjustable secured nickel bronze top and:

.1 Plugs: bolted bronze with neoprene gasket.

.2 Cover for Unfinished Concrete Floors: nickel bronze round or square, gasket, vandal-proof screws.

.3 Cover for Terrazzo Finish: polished nickel bronze with recessed cover for filling with terrazzo, vandal-proof locking screws.

.4 Cover for Tile and Linoleum Floors: polished nickel bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.

.5 Cover for Carpeted Floors: polished nickel bronze with deep flange cover for carpet infill, complete with carpet retainer vandal-proof locking screws.

2.5 WATER HAMMER ARRESTORS

.1 Stainless steel construction, bellows type: to PDI-WH201.

2.6 VACUUM BREAKERS

.1 Breakers: to CSA-B64 Series, vacuum breaker hose connection.

2.7 PLUMBING VENT ROOF TERMINATIONS

.1 Vent stack flashing:

.1 Thaler SJ-27, 18” (457 mm) high removable cap, 0.064” (1.6 mm) mill finish 1100-OT alloy aluminum, diameter and seals to suit vent piping, urethane insulation pre-molded to inner side of sleeve; to CSA B272-93; with removable cap and EPDM base seal; bituminous painted deck flange.

2.8 BACKFLOW PREVENTER (RPZ)

.1 The assembly shall consist of an internal pressure differential relief valve located in a zone between two positive seating check modules with captured springs and silicone seat discs. Seats and seat discs shall be replaceable in both check modules and the relief valve.

.2 There shall be no threads or screws in the waterway exposed to line fluids.

.3 Service of all internal components shall be through a single access cover secured with stainless steel bolts.

.4 Body and shutoffs shall be constructed using lead free cast copper silicon alloy materials. Lead free RPZ shall comply with local codes and standards, where applicable, requiring reduced lead content.

.5 The assembly shall also include two resilient seated isolation valves, four resilient seated test cocks and an air gap drain fitting.

.6 The assembly shall meet the requirements of: USC; ASSE Std. 1013; AWWA Std. C511; CSA B64.4.

.7 Acceptable Product: Watts model LF009 or Approved Equal in accordance with frontend clause B6.

2.9 TRAP SEAL PRIMERS

.1 Single Fixture Application:

.1 Pressure drop activated trap seal primer; brass, with integral pressure vacuum breaker (PVB) backflow preventer, NPS ½" (13 mm) solder ends, NPS ½" (13 mm) drip line connection.

.2 Acceptable Product: Watts MS-801 or Approved Equal in accordance with frontend clause B6.

.2 Multiple Fixture Application:

.1 Primer:

.1 Pressure drop activated trap seal primer, suitable for multiple outlets; brass, with integral pressure vacuum breaker (PVB) backflow preventer, NPS ½" (13 mm) threaded ends.

.2 Acceptable Product: Mifab M-500 or Approved Equal in accordance with frontend clause B6.

.2 Distribution Unit:

.1 Receives a metered amount of water from a primer. ABS body, ½" (13 mm) male inlet connection, ½" (13 mm) copper tube drip line connections.

.2 Acceptable Product: Mifab MI-DU or Approved Equal in accordance with frontend clause B6.

.3 Electronic Trap Primer, Single or Multiple Fixture Applications

.1 Factory programmed, 5-port, lead-free electronic trap primer providing a six second water injection to traps every 24 hours. Trap primer features a galvanized steel combination surface or recessed housing and cover, ½" (13 mm) solder copper inlet connection, brass ball-type stop valve, slow closing 24 VAC solenoid valve with integral strainer, 120 - 24 VAC transformer, brass atmospheric vacuum breaker, PEX waterway, and anti-scaling multi-port manifold with five ½" 13 mm male PEX outlet connections.

.2 Acceptable Product: Zurn Z1020Xl or Approved Equal in accordance with frontend clause B6.

2.10 STRAINERS

.1 125 psi (862 kPa), Y-type with 20 mesh, monel, bronze or stainless steel removable screen

.2 NPS 2” (50 mm) and under: bronze body, screwed ends, with brass cap

.3 NPS 2-1/2” (63 mm) and over: cast iron body, flanged ends with bolted cap.

2.11 THERMAL EXPANSION TANK, ET-1

.1 Head and shell design with internal diaphragm tank(s).

.2 Designed and constructed per ASME Code Section VIII, Division 1.

.3 Anti-Legionella liner neutralizes bacteria on contact.

.4 Tested to JIS Z 2801 for reduction of Legionella, staphylococcus and E. coli.

.5 Follows ASHRAE 188 Anti-Legionella guidelines.

.6 Diaphragm meets NSF/ANSI 61 standards; NAF compliant.

.7 Relief valve and connection at top, to manufacturer’s recommendations

.8 Performance:

.1	Tank acceptance volume:	3.2 USG
.2	Tank volume:	6.4 USG
.3	Max operating temperature:	200 °F
.4	Max working pressure:	150 psig
.5	Fluid type:	Water

.9 Acceptable Product: Amtrol THERM-X-TROL ST-12C-DD or Approved Equal in accordance with frontend clause B6.

2.12 NON-FREEZE HOSE BIBB, HB-1:

.1 ¾” (19 mm) diameter, exposed anti-siphon automatic draining wall hydrant. Complete with non-freeze integral backflow preventer, bronze casing, all bronze interior parts, non-turning operating rod with free-floating compression closure valve, replaceable bronze seat and seat washer, and combination 3/4" (19 mm) female or 1" (25 mm) male straight IP inlet. Stainless steel face with operating key.

.2 Acceptable Product: Zurn model Z1310 or Approved Equal in accordance with frontend clause B6.

2.13 OIL SEPARATOR:

.1 General:

.1 Separator shall be certified to IAPMO ICONTRACTOR 325 and carry a UPC listing.
.2 Separator shall be constructed of polyethylene.
.3 Separator shall be manufactured for above- or below-grade installation.
.4 Field-adjustable riser system is available as an option to bring manhole cover to grade.
.5 Cover shall provide water/gas-tight seal and have a maximum 16,000 lbs. load capacity.

.2 Performance:

.1 4" Plain End inlet/outlet, 3" Plain End vents, C24-H cover standard.
.2 Certified max flow rate: 50 GPM.
.3 Liquid capacity: 110 Gallons (14.7 cu. ft.).
.4 Oil capacity: 27.5 Gallons.
.5 Solids capacity: 11 Gallons.
.6 Unit weight w/ standard cover: 120 lbs.
.7 Maximum operating temperature 140 F continuous.
.8 Oil Level Monitoring System:
.1 UL Listed
.2 Provides warning of high oil level conditions with interface float.
.3 Single phase, 120 volt, 60 hertz power required.
.4 NEMA 4X fiberglass, corrosion resistant, weatherproof enclosure suitable for outdoor use and damp environments.
.5 Audible Alarm Buzzer, 95dB pulsing horn with no timeout.
.6 High Oil Light, indicates oil has accumulated below the oil interface float or the tank liquid level is below the High Oil Interface Float.
.7 Power On light inside enclosure. Visible from the outside. Green light indicates the power is on.
.8 Horn off button that silences the audible alarm when pressed.
.9 Test button that when pressed will test the system electronics.
.10 Locking clasp on door.
.11 Alarm bell stays on until reset. Light stays on until reset, even if level goes down.
.12 Unit comes supplied with extra dry contact for connection to a building alarm system.

.3 Acceptable Product:

.1 Striem OS-75-SS or Approved Equal in accordance with frontend clause B6.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

.1 Install in accordance with Manitoba Plumbing Code and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.3 CLEANOUTS

.1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required code, and as indicated.

.2 All fixture clean-outs installed above the flood rim of fixture.

.3 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.4 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4” (100 mm).

3.4 PLUMBING VENT TERMINATIONS

.1 Plumbing vents shall be installed with a minimum separation distance of 11’-6” (3.5 m) from outdoor intakes.

3.5 WATER HAMMER ARRESTORS

.1 Install on branch supplies to fixtures or group of fixtures and where indicated.

3.6 TRAP SEAL PRIMERS

.1 Install for floor drains and elsewhere, as indicated.

.2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space.

.3 Install plastic tubing to floor drain.

3.7 STRAINERS

.1 Install with sufficient room to remove basket.

3.8 START-UP

.1 In accordance with Section 21 05 01 General Provisions – Mechanical, supplemented as specified herein.

.2 Timing: start-up only after:

- .1 Pressure tests have been completed.
- .2 Disinfection procedures have been completed.
- .3 Certificate of static completion has been issued.
- .4 Water treatment systems operational.

.3 Provide continuous supervision during start-up.

3.9 TESTING AND ADJUSTING

.1 In accordance with Section 21 05 01 General Provisions – Mechanical, supplemented as specified.

.2 Timing:

- .1 After start-up deficiencies rectified.
- .2 After inspection of Authority having Jurisdiction has been completed.

.3 Application tolerances:

- .1 Pressure at fixtures: +/- 70kPa.
- .2 Flow rate at fixtures: +/- 20%.

.4 Adjustments:

- .1 Verify that flow rate and pressure meet design criteria.
- .2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.

.5 Floor drains:

- .1 Verify operation of trap seal primer if applicable.
- .2 Prime, using trap primer if applicable.
- .3 Check operations of flushing features.
- .4 Check security, accessibility, removability of strainer.
- .5 Clean out baskets (if applicable),
- .6 Adjust heights as necessary.

.6 Vacuum breakers, backflow preventers, backwater valves:

- .1 Test tightness, accessibility for O&M of cover and of valve.
- .2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.
- .3 Verify visibility of discharge from open ports.

.7 Roof drains:

- .1 Check location at low points in roof.

.2 Check security, removability of dome.
.3 Adjust weirs to suit actual roof slopes, meet requirements of design.
.4 Clean out sumps.
.5 Verify provisions for movement of roof systems.

.8 Access doors:

.1 Verify size and location relative to items to be accessed.

.9 Cleanouts:

.1 Verify covers are gas-tight, secure, yet readily removable.

.10 Water hammer arrestors:

.1 Verify proper installation of correct type of water hammer arrester.

.11 Strainers:

.1 Clean out repeatedly until clear.
.2 Verify accessibility of cleanout plug and basket.
.3 Verify that cleanout plug does not leak.

.12 Training:

.1 In accordance with Section 21 05 01 General Provisions – Mechanical.
.2 Demonstrate full compliance with Design Criteria.

.13 Expansion Tanks

.1 Adjust expansion tank pressure to suit design criteria.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-B45 Series, Plumbing Fixtures.
.2 CAN/CSA-B125.3, Plumbing Fittings.
.3 CAN/CSA-B651, Accessible Design for the Built Environment.

.2 Green Seal Environmental Standard (GSES)

.1 Standard GS-36, Commercial Adhesives.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for washroom fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Indicate fixtures and trim:

.1 Dimensions, construction details, roughing-in dimensions.
.2 Factory-set water consumption per flush at recommended pressure.
.3 For water closets, urinals: minimum pressure required for flushing.

.4 Shop Drawings:

.1 Provide drawings in accordance with Section 21 05 01 General Provisions – Mechanical.

1.3 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for washroom fixtures, for incorporation into manual specified in Section 21 05 01 General Provisions – Mechanical.

.2 Include:

.1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
.2 Details of operation, servicing, maintenance.
.3 List of recommended spare parts.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 PRODUCTS

2.1 MANUFACTURED UNITS

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.3.

.3 Exposed plumbing brass to be chrome plated.

.4 Number, locations: as indicated.

.5 Fixtures in any one location to be product of one manufacturer and of same type.

.6 Trim in any one location to be product of one manufacturer and of same type.

2.2 WATER CLOSET, WC-1:

.1 Vitreous China:

.1 Vitreous china elongated bowl with antimicrobial finish, 425 mm (16 3/4 in) in height, siphon jet action, 54 mm (2 1/8 in) completely glazed trapway, bolt caps, 38 mm (1 1/2 in) top spud connection, 4.8 L (1.28 US gal) per flush.

.2 Acceptable Product:

.1 Zurn Z5665-BWL1-AM or Approved Equal in accordance with frontend clause B6.

.2 Flush Valve:

.1 Battery operated exposed quiet flush valve for water closets, (4 type C batteries), TPE chloramine resistant dual seal diaphragm with triple filter by-pass, ADA compliant oscillating handle, control stop with vandal resistant stop cap, cast wall flange, vacuum breaker tube with water supply 406 mm (16 in) above closet bowl, polished chrome finish, dual action of the ceramic disc cartridge and motor gear-driven operation, top mount automatic detection with mechanical manual override button, polycarbonate high resistant casing with a metallic chrome cover, luminating action with low frequence sonar, 4.8 L (1.28 US gal) per flush.

.2 Acceptable Product:

.1 Zurn ZER6000AV-1-TM-HET or Approved Equal in accordance with frontend clause B6.

.3 Seat:

.1 Solid plastic elongated seat for super-intensive use with anti-microbial protection, open front, coverless, molded bumper guard, stainless steel check hinges and fasteners. (White).

.2 Acceptable Product:

.1 Zurn Z5956SS-AM or Approved Equal in accordance with frontend clause B6.

.4 Approved Equals:

.1 Kohler, Delta, American Standard equivalent shall meet or exceed specified products.

2.3 ACCESSIBLE LAVATORY, LAV-1:

.1 Vitreous China:

.1 Vitreous china wall hung lavatory for barrier-free application, 581 x 514 mm (22 7/8 x 20 1/4 in), backsplash, front overflow, pre-drilled for concealed arms, drilled single hole.

.2 Dimensions: 581 x 514 mm (22 7/8 x 20 1/4")

.3 Acceptable Product:

.1 Zurn Z5321 or Approved Equal in accordance with frontend clause B6.

.2 Faucet:

.1 Hardwired electronic sensor faucet with ceramic disc cartridge and motor gear-driven operation, 1.9 L/min. (0.5 usgpm) vandal resistant spray spout outlet, single hole installation, polished chrome finish, infrared convergence type proximity sensor, on-demand activation with a 30 seconds run time, in-line filter, pre-mixed water supply. Includes battery backup pack to faucet during power outages. Supplied with 85 in cable wire (CWB).

.2 Acceptable Product:

.1 Zurn ZG6913-CWB-F or Approved Equal in accordance with frontend clause B6.

.3 Power Converter (One (1) per Washroom Group, Max eight (8) faucets):

.1 Hardwired power converter 120VAC/7.6 VDC, 2 amp., capable of supplying for 8 faucets or 8 flush valves or 8 faucets/ flush valves combined. When used with W1 connected products, capable of supplying for 6 faucets or 6 flush valves or 6 faucets/ flush valves combined.

.2 Accessories:

.1 Mini junction electrical box, maximum of 8 units

.3 Acceptable Product:

.1 Zurn P6000-HW6 with Zurn P6000-MJ or Approved Equal in accordance with frontend clause B6.

.4 Stops (Two (2) per Lavatory):

.1 Lavatory extra heavy duty quarter turn stops, low lead, DN 1/2 in compression x 3/8 in compression, loose key, flanges chrome plated finish.

.2 Acceptable Product:

.1 Zurn ZH8824XL-LKQ-PC/Z8952-58 or Approved Equal in accordance with frontend clause B6.

.5 Thermostatic Mixing Valve:

.1 Thermostatic mixing valve supplying 1 or multiple lavatories/sinks designed for point of use; 37.8 L/min (10 usgpm) flow at a 45 psi pressure differential; temperature setting at 35 to 46 ºC (95 to 115 ºF) with a + 1.78 ºC (3 ºF) precision at a 0.95 L/min (0.25 usgpm) minimum flow; inlets check valves with incorporated filters, 1/2" sweat inlets and outlet.

.2 Acceptable Product:

.1 Zurn Wilkins 12-ZW1070XL-C or Approved Equal in accordance with frontend clause B6.

.6 Drain Assembly:

.1 "Daisy" type strainer offset drain assembly, cast brass body, 32 mm (1 1/4 in), polished chrome finish.

.2 Acceptable Product:

.1 OS&B 37DWC or Approved Equal in accordance with frontend clause B6.

.7 P-Trap:

.1 Cast brass adjustable P-trap, 32 mm (1 1/4 in) with deep wall flange and cleanout, chrome plate finish.

.2 Acceptable Product:

.1 Zurn Z8700-8BD-PC or Approved Equal in accordance with frontend clause B6.

.8 Carrier:

.1 Concealed single wall hung carrier, steel uprights with welded feet, cast iron adjustable headers, concealed arms, alignment truss and mounting fasteners.

.2 Acceptable Product:

.1 Zurn Z1231 or Approved Equal in accordance with frontend clause B6.

.9 Protector:

.1 Antimicrobial protectors, resists thermal transfers for P-trap, offset drain assembly, stop and supply.

.2 Approved Product:

.1 Zurn Z8946-3-NT or Approved Equal in accordance with frontend clause B6.

.10 Approved Equals:

.1 Kohler, Delta, American Standard equivalent shall meet or exceed specified products.

2.4 LAVATORY, LAV-2:

.1 Vitreous China:

.1 Vitreous china wall hung lavatory, 483 x 432 mm (19 x 17 in), oval basin, lowered backsplash, front overflow, mounting bracket, drilled for single hole.
.2 Dimensions: 483 x 432 mm (19 x 17")
.3 Acceptable Product:

.1 Zurn Z5351 or Approved Equal in accordance with frontend clause B6.

.2 Faucet:

.1 Hardwired electronic sensor faucet with ceramic disc cartridge and motor gear-driven operation, 1.9 L/min. (0.5 usgpm) vandal resistant spray spout outlet, single hole installation, polished chrome finish, infrared convergence type proximity sensor, on-demand activation with a 30 seconds run time, in-line filter, pre-mixed water supply. Includes battery backup pack to faucet during power outages. Supplied with 85 in cable wire (CWB).
.2 Acceptable Product:

.1 Zurn ZG6913-CWB-F or Approved Equal in accordance with frontend clause B6.

.3 Power Converter (One (1) per Washroom Group, Max eight (8) faucets):

.1 Hardwired power converter 120VAC/7.6 VDC, 2 amp., capable of supplying for 8 faucets or 8 flush valves or 8 faucets/ flush valves combined. When used with W1 connected products, capable of supplying for 6 faucets or 6 flush valves or 6 faucets/ flush valves combined.
.2 Accessories:

.1 Mini junction electrical box, maximum of 8 units
.3 Acceptable Product:

.1 Zurn P6000-HW6 with Zurn P6000-MJ or Approved Equal in accordance with frontend clause B6.

.4 Stops (Two (2) per Lavatory):

.1 Lavatory extra heavy duty quarter turn stops, low lead, DN 1/2 in compression x 3/8 in compression, loose key, flanges chrome plated finish.
.2 Acceptable Product:

.1 Zurn ZH8824XL-LKQ-PC/Z8952-58 or Approved Equal in accordance with frontend clause B6.

.5 Thermostatic Mixing Valve:

.1 Thermostatic mixing valve supplying 1 or multiple lavatories/sinks designed for point of use; 37.8 L/min (10 usgpm) flow at a 45 psi pressure differential; temperature setting at 35 to 46 ºC (95 to 115 ºF) with a + 1.78 ºC (3 ºF) precision at a 0.95 L/min (0.25 usgpm) minimum flow; inlets check valves with incorporated filters, 1/2" sweat inlets and outlet.

.2 Acceptable Product:

.1 Zurn Wilkins 12-ZW1070XL-C or Approved Equal in accordance with frontend clause B6.

.6 Drain Assembly:

.1 "Daisy" type strainer drain assembly, cast brass body, 32 mm (1 1/4 in), polished chrome finish.

.2 Acceptable Product:

.1 OS&B 37D or Approved Equal in accordance with frontend clause B6.

.7 P-Trap:

.1 Cast brass adjustable P-trap, 32 mm (1 1/4 in) with deep wall flange and cleanout, chrome plate finish.

.2 Acceptable Product:

.1 Zurn Z8700-8BD-PC or Approved Equal in accordance with frontend clause B6.

.8 Carrier:

.1 Concealed wall hung carrier, extra-heavy duty adjustable plate, steel uprights with welded feet, mounting fastener.

.2 Acceptable Product:

.1 Zurn Z1224 or Approved Equal in accordance with frontend clause B6.

.9 Approved Equals:

.1 Kohler, Delta, American Standard equivalent shall meet or exceed specified products.

2.5 SINK, SK-1:

.1 Basin:

.1 Stainless steel double bowl sink, 838 x 495 x 194 mm (33 x 19 1/2 x 7 5/8 in), type 304, 18 gauge, satin finish, sound deadening pads, rim seal pre-installed, installation kit, 89 mm (3 1/2 in) centered basket strainer assembly, pre-drilled single hole center.

.2 Acceptable Product:

.1 Elkay LR33191-LK99 or Approved Equal in accordance with frontend clause B6.

.2 Faucet:

.1 Single lever faucet with pull-out spray, cast brass body, ceramic disc cartridges, polished chrome finish, with lever handle, 224 mm (8 13/16 in) in swivel 360° gooseneck spout with aerator limiting flow to 6.8 lpm (1.8 gpm). Maximum countertop thickness 76 mm (3 in).

.2 Acceptable Product:

.1 Elkay LKAV3032CR or Approved Equal in accordance with frontend clause B6.

.3 Stops (Two (2) per Sink):

.1 Extra heavy duty quarter turn stops, low lead, DN 1/2 in compression, loose key, vertical flexible stainless braided hoses of 10 x 300 mm (3/8 x 12 in), flange, chrome plated finish.

.2 Acceptable Product:

.1 Zurn ZH8824XL-LRLKQ-8860-12-PC or Approved Equal in accordance with frontend clause B6.

.4 P-Trap:

.1 Cast brass adjustable P-Trap, 38 mm (1 1/2 in) with cleanout, deep seal flange, polished chrome finish.

.2 Acceptable Product:

.1 Zurn Z8702-9BD or Approved Equal in accordance with frontend clause B6.

.5 Approved Equals:

.1 Kohler, Delta, American Standard equivalent shall meet or exceed specified products.

2.6 LABORATORY SINK, SK-2:

.1 Basin:

.1 Stainless steel single bowl sink, 1295 x 508 x 254 mm (51 x 20 x 10 po), 316 type, 18 gauge, satin finish, square corners (standard), sound deadening pads, instal-lation kit, 38 mm (1 1/2 in) duplex type drain assembly situated center of bowl.

.2 Acceptable Product:

.1 Can-Aqua CA-EAPD-CC-DU-J/316 or Approved Equal in accordance with frontend clause B6.

.2 Faucet:

.1 Polished chrome-plated laboratory faucet with integral shank, quarter turn ceramic disc cartridges and a 152 mm (6 in) centerline rigid gooseneck spout with vacuum breaker, with a serrated nozzle, vandal-resistant 64 mm (2 1/2 in) color-coded metal lever handles, mounting hardware and 10 mm (3/8 in) stainless steel flex connection hoses.

.2 Acceptable Product:

.1 Zurn Z826U1-XL-6M or Approved Equal in accordance with frontend clause B6.

.3 Stops (Two (2) per Sink):

.1 Lavatory extra heavy duty quarter turn stops, low lead, DN 1/2 in compression x 3/8 in compression, loose key, flanges chrome plated finish.

.2 Acceptable Product:

.1 Zurn ZH8824XL-LKQ-PC/Z8952-58 or Approved Equal in accordance with frontend clause B6.

.4 P-Trap:

.1 Polypropylene P-trap with union connections with a 1-1/2 in. diameter.

.2 Acceptable Product:

.1 +GF+ 52721(X) or Approved Equal in accordance with frontend clause B6.

.5 Acid Neutralizing Cartridge:

.1 Glass filled polypropylene neutralization cartridge for under the counter installation replacing the p-trap, self-contained with granular particles (phix media) composed of non-hazardous solid alkali non-resin materials, lasting 25-30 times longer. 1 1/2" inlet and outlet connection (adaptor not included). Support bracket included.

.2 Acceptable Product:

.1 Zurn model PHIX or Approved Equal in accordance with frontend clause B6.

.6 Approved Equals:

.1 Kohler, Delta, American Standard equivalent shall meet or exceed specified products.

2.7 UTILITY SINK, SK-3

.1 Sink:

.1 Double stainless steel utility sink on legs, 1303 x 685 mm (51 1/3 x 27 1/2 in), 304 type, 18 gauge, satin finish, 0.625 radius corner, 229 mm (9 in) backsplash, rounded rim, stainless steel legs with adjustable feet, 89 mm (3 1/2 in) basket strainer assembly situated in center of bowl. Backsplash predrilled as per required.

.2 Acceptable Product:

.1 Can-Aqua CA-EUPD-28 or Approved Equal in accordance with frontend clause B6.

.2 Faucet:

.1 Wall mount cast brass service sink faucet, low lead, swivel inlets (with integral stops) providing adjustable centers from 184 to 222 mm (7 1/4 to 8 3/8 in), quarter turn ceramic disc cartridges, polished chrome finish, 64 mm

(2 1/2 in) vandal-resistant color-coded metal lever handles, 152 mm (6 in) swing spout with 8.3 L/min. (2.2 usgpm) vandal-resistant pressure compensating female laminar flow.

.2 Standards: ASME A112. 18. 1/CSA B125.1

.3 Acceptable Product:

.1 Zurn Z842F1-XL-4F-LSI or Approved Equal in accordance with frontend clause B6.

.3 P-Trap:

.1 Cast brass adjustable P-Trap, 38 mm (1 1/2 in) with cleanout, deep seal flange, polished chrome finish.

.2 Acceptable Product:

.1 Zurn Z8702-9BD or Approved Equal in accordance with frontend clause B6.

2.8 MOP SKINK, MS-1:

.1 Basin:

.1 Molded high density composite mop basin, 610 x 610 x 254 mm (24 x 24 x 10 po), 44 x 16 mm (1 3/4 x 5/8 in) rim, 76 mm (3 in) PVC drain body with stainless steel dome strainer/lint basket, NPS 76 mm (3 in) gasketed outlet.

.2 Acceptable Product:

.1 Zurn Z1996-24 or Approved Equal in accordance with frontend clause B6.

.2 Faucet:

.1 Wall-mount polished chrome-plated cast brass 203mm (8 in) sink faucet, low lead, short swivel inlets, 184 to 222 mm (7 1/4 to 8 3/4 in) adjustable centers, integral service stops, ceramic disc cartridges, polished chrome finish, 64 mm (2 1/2 in) vandal resistant color-coded lever handles, rigid spout with atmospheric vacuum breaker, wall brace, pail hook and hose threaded outlet, outlet at 232 mm (9 1/8 in) from finished wall. Integral service/check stops.

.2 Acceptable Product:

.1 Zurn Z843M1-XL-CSor Approved Equal in accordance with frontend clause B6.

.3 Bumper Guard (Provide one (1) for each exposed side of basin):

.1 Stainless steel bumper guard. Quantity to be determined. 610 mm (24 in) in length.

.2 Acceptable Product:

.1 Zurn Z1996-BS24 or Approved Equal in accordance with frontend clause B6.

.4 Hose:

.1 Reinforced hose for intensive use 16 x 762 mm (5/8 x 30 in) in length with brass coupling with hose bracket with rubber grip.
.2 Acceptable Product:
.1 Zurn Z1996-HH or Approved Equal in accordance with frontend clause B6.

.5 Wall Guard:

.1 For Adjacent Corner Applications:
.1 Stainless steel 2 panels wall guard, 610 mm (24") for corner installation, 20 gauge, satin finish, 305 mm (1/2") high, corner molding.
.2 Acceptable Product:
.1 Zurn Z1996-WG24 or Approved Equal in accordance with frontend clause B6.
.2 For Adjacent Single Wall Applications:
.1 Stainless steel single panel wall guard for adjacent wall, 20 gauge, satin finish, 305 mm (12 in) high, corner molding.
.2 Acceptable Product:
.1 Zurn Z1996-WG (1) or Approved Equal in accordance with frontend clause B6.

.6 Approved Equals:

.1 Kohler, Delta, American Standard equivalent shall meet or exceed specified products.

2.9 FIXTURE PIPING:

.1 Hot and cold water supplies to fixtures:

.1 Chrome plated flexible supply pipes with screwdriver stop, reducers, escutcheon.

.2 Waste:

.1 Brass P trap with clean out on fixtures not having integral trap.
.2 Chrome plated in exposed places.

2.10 FIXTURE CARRIERS:

.1 Factory manufactured floor-mounted carrier systems for wall-mounted fixtures. Supplied to suit plumbing fixture it serves.

Part 3 EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Mounting heights:

.1 Standard: to manufacturer's recommendations or as indicated, measured from finished floor.
.2 Wall-hung fixtures: as indicated.
.3 Barrier free: to most stringent Manitoba Building Code, CAN/CSA B651.

.2 Water Closets:

.1 Install 100% silicone at the base of the fixture, or where the fixture meets the wall or floor.

3.3 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments:

.1 Adjust water flow rate to design flow rates.
.2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
.3 Adjust flush valves to suit actual site conditions.
.4 Adjust urinal flush timing mechanisms.
.5 Set controls of automatic flush valves for WCs and urinals to prevent unnecessary flush cycles.

.3 Checks:

.1 Water closets, urinals: flushing action.
.2 Aerators: operation, cleanliness.
.3 Vacuum breakers, backflow preventers: operation under all conditions.

.4 Thermostatic controls:

.1 Verify temperature settings, operation of control, limit and safety controls.

3.4 CLEANING

.1 Clean in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Use of mechanical systems during construction.

1.2 USE OF SYSTEMS

.1 Use of new and/or existing permeant heating, ventilating or air conditioning systems for supplying temporary heat, ventilation or air conditioning is *not* permitted.

Part 2 PRODUCTS

.1 Not Used.

Part 3 EXECUTION

.1 Not Used.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.

.2 Canadian Standards Association (CSA)

.1 CSA B149.1, Natural Gas and Propane Installation Code.

.3 Green Seal Environmental Standards (GSES)

.1 Standard GS-11 Environmental Standard for Paints and Coatings

.4 National Research Council Canada

.1 National Fire Code of Canada (NFCC).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheets for piping and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 21 05 01 General Provisions – Mechanical and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 PRODUCTS

2.1 MATERIAL

.1 Paint: zinc-rich to CAN/CGSB-1.181.

.1 Paints: in accordance with manufacturer's recommendations for surface conditions.
.2 Primer: maximum VOC limit to Standard GS-11.
.3 Paints: maximum VOC limit to Standard GS-11.

.2 Sealants: in accordance with Section 07 92 00 Joint Sealants.

.3 Fire Stopping: in accordance with Section 07 84 00 Fire Stopping.

Part 3 EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.3 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer without interrupting operation of other system, equipment, components.

3.4 DRAINS VALVES

.1 Install piping with grade in direction of flow except as indicated.

.2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.

.3 Pipe each drain valve discharge separately to above floor drain.

.1 Discharge to be visible.

.4 Drain valves:

.1 Low points & section isolating valves: Minimum NPS ¾” (19 mm) ball valve unless indicated otherwise, with hose end male thread, cap and chain.

.2 Equipment: line size ball valve unless indicated otherwise, with hose end male thread, cap and chain.

.5 Hose bibbs *not* permitted.

3.5 AIR VENTS

.1 Install manual air vents and automatic air vents at high points (anywhere air can become trapped) in piping systems.

.2 Install isolating valve at each automatic air valve.

.3 Install drain piping to approved location and terminate where discharge is visible.

3.6 DIELECTRIC CONNECTIONS

.1 General: compatible with system, to suit pressure rating of system.

.2 Locations: where dissimilar metals are joined.

.3 NPS 2” (50 mm) and under: isolating unions or bronze valves.

.4 Over NPS 2” (50 mm): isolating flanges.

.5 Dielectric *couplings* are not permitted.

3.7 PIPEWORK INSTALLATION

.1 Screwed fittings jointed with Teflon tape.

.2 Protect openings against entry of foreign material.

.3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.

.4 Assemble piping using fittings manufactured to ANSI standards.

.5 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.

.1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.

.6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.9 Install, except where indicated, to permit separate thermal insulation of each pipe.

.10 Group piping wherever possible and as indicated.

.11 Ream pipes, remove scale and other foreign material before assembly.

.12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.1 Hydronic systems be installed with reducers flat on top (FOT).
.2 Steam and condensate systems shall be installed with reducers flat on bottom (FOB).

.13 Provide for thermal expansion as indicated.

.14 Valves:

.1 Install in accessible locations.
.2 Remove interior parts before soldering.
.3 Install with stems above horizontal position unless indicated.
.4 Valves accessible for maintenance without removing adjacent piping.
.5 Install globe valves in bypass around control valves.
.6 Use butterfly or ball valves at branch take-offs for isolating purposes except where specified.
.7 Install butterfly valves between weld neck flanges to ensure full compression of liner.
.8 Use chain operators on valves NPS 2 ½" (63 mm) and larger where installed more than 8 ft (2.4 m) above floor in Mechanical Rooms.
.9 Check Valves:

.1 Install swing check valves in horizontal lines on discharge of pumps and as indicated.

.2 Install silent check valves in vertical pipes with downward flow and as indicated

3.8 SLEEVES

.1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.

.2 Material: schedule 40 black steel pipe.

.3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.

.4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

.5 Installation:

.1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.
.2 Other floors: terminate 1” (25 mm) above finished floor.
.3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.

.6 Sealing:

.1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.
.2 Elsewhere:

.1 Provide space for firestopping.

.2 Maintain fire rating integrity.

.3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.
.4 Ensure no contact between copper pipe or tube and sleeve.

3.9 ESCUTCHEONS

.1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.

.2 Construction: one-piece type with set screws.

.1 Chrome or nickel-plated brass or type 302 stainless steel.

.3 Sizes: outside diameter to cover opening or sleeve.

.1 Inside diameter to fit around pipe or outside of insulation if so provided.

3.10 PREPARATION FOR FIRE STOPPING

.1 Install firestopping within annular space between pipes, ducts, insulation and adjacent fire separation in accordance with Section 07 84 00 - Fire Stopping and Smoke Seals.

.2 Uninsulated unheated pipes not subject to movement: no special preparation.

.3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe movement without damaging fires topping material or installation.

.4 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers at fire separation.

3.11 FLUSHING OUT OF PIPING SYSTEMS

.1 Flush systems in accordance with Section 23 25 00 HVAC Water Treatment Systems.

3.12 PRESSURE TESTING OF PIPEWORK

.1 Refer to Section 21 05 01 General Provisions – Mechanical.

3.13 EXISTING SYSTEMS

.1 Connect into existing piping systems at times approved by Contract Administrator.

.2 Request written approval by Contract Administrator 10 days minimum, prior to commencement of work.

.3 Be responsible for damage to existing plant by this work.

3.14 CLEANING

.1 Cleaning in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Electrical motors, drives and guards for mechanical equipment and systems.

.2 Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

.3 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 22 and 23. Refer to Division 26 for quality of materials and workmanship.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).

.2 Electrical Equipment Manufacturers' Association Council (EEMAC)

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals: in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Product Data:

.1 Submit manufacturer’s printed product literature, specifications and datasheet in accordance with Section 21 05 01 General Provisions – Mechanical.

.3 Quality Control:

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.4 Closeout Submittals:

.1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 21 05 01 General Provisions – Mechanical.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements: work to be performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, store and handle materials in accordance with manufacturer's written instructions.

Part 2 PRODUCTS

2.1 GENERAL

.1 Motors: high efficiency, in accordance with local Hydro company standards and to ASHRAE 90.1.

2.2 MOTORS

.1 Provide electric motors for all equipment supplied in this Division. Motors to operate at 1800 rpm, unless noted otherwise. Motor design shall comply with Canadian Electrical Code requirements. All electric motors supplied shall be capable of being serviced locally.

.2 Motors 1 hp (0.75 kW) and larger shall be high efficiency motors as defined and tested to CSA C390 or IEEE 112B and NEMA. Motors 0.5 hp (0.37 kW) and over to be 575 V/3 ph/60 Hz unless specified otherwise. Motors under 0.5 hp (0.37 kW) to be 120V/1 ph/60 Hz.

.3 All three phase motors shall have a service factor of 1.15 times nominal rated horsepower of the motor.

.4 Determine from electrical drawings and specifications, voltage characteristics applying to each individual motor. Where motor voltages are mentioned in this specification ordering motors.

2.3 TEMPORARY MOTORS

.1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Contract Administrator for temporary use. Work will only be accepted when specified motor is installed.

2.4 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.

.3 For motors under 10 HP (7.46 kW): standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.4 For motors 10 HP (7.46 kW) and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.

.5 Correct size of sheave determined during commissioning.

.6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.7 Motor slide rail adjustment plates to allow for centre line adjustment.

.8 Supply one set of spare belts for each set installed.

2.5 DRIVE GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives:

- .1 Expanded metal screen welded to steel frame.
- .2 Minimum 0.047” (1.2 mm) thick sheet metal tops and bottoms.
- .3 1.5” (38 mm) diameter holes on both shaft centres for insertion of tachometer
- .4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.

.5 Guard for flexible coupling:

- .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
- .2 Securely fasten in place.
- .3 Removable for servicing.

.6 Unprotected fan inlets or outlets:

- .1 Wire or expanded metal screen, galvanized, ¾” (19 mm) mesh.
- .2 Net free area of guard: not less than 80% of fan openings.
- .3 Securely fasten in place.

.4 Removable for servicing.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Fasten securely in place.

.2 Make removable for servicing, easily returned into, and positively in position.

.3 Division 26 Electrical to provide starters for all motors, except as otherwise noted.

.4 Division 26 Electrical shall provide wiring from starters to motors.

3.3 CLEANING

.1 Proceed in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American National Standards Institute / American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B31.1, Power Piping.
.2 ANSI/ASME B31.3, Process Piping.
.3 ANSI/ASME B31.9, Building Services Piping.
.4 ANSI/ASME Boiler and Pressure Vessel Code:

.1 BPVC Section I: Power Boilers.

.2 BPVC Section V: Non-destructive Examination.

.3 BPVC Section IX: Welding and Brazing Qualifications.

.2 American National Standards Institute / American Water Works Association (ANSI/AWWA)

.1 ANSI/AWWA C206, Field Welding of Steel Water Pipe.

.3 American Welding Society (AWS)

.1 AWS C1.1M/C1.1, Recommended Practices for Resistance Welding.
.2 AWS Z49.1, Safety in Welding, Cutting and Allied Process.
.3 AWS W1, Welding Inspection Handbook.

.4 Canadian Standards Association (CSA International)

.1 CSA W47.2, Certification of Companies for Fusion Welding of Aluminum
.2 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.
.3 CSA B51, Boiler, Pressure Vessel and Pressure Piping Code.
.4 CSA-W117.2, Safety in Welding, Cutting and Allied Processes.
.5 CSA W178.1, Certification of Welding Inspection Organizations.
.6 CSA W178.2, Certification of Welding Inspectors.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 21 05 01 General Provisions – Mechanical.

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Welders:

.1 Welding qualifications in accordance with CSA B51 and local Authority Having Jurisdiction.

.2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.

.3 Submit welder's qualifications to Contract Administrator.

.4 Each welder to possess identification symbol issued by authority having jurisdiction.

.5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.

.2 Inspectors:

.1 Inspectors qualified to CSA W178.2.

.3 Certifications:

.1 Registration of welding procedures in accordance with CSA B51.
.2 Copy of welding procedures available for inspection.
.3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with 21 05 01 General Provisions – Mechanical.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

Part 2 PRODUCTS

2.1 ELECTRODES

.1 Electrodes: in accordance with CSA W48 Series.

Part 3 EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 QUALITY OF WORK

.1 Welding: in accordance with ANSI/ASME B31, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1 and applicable requirements of provincial authority having jurisdiction.

3.3 PIPE WELDING REGULATIONS

.1 Pipe fabrication shall conform to the American National Standard, ASME Code for B31.1 – Power Piping and B31.9 – Building Services Piping Code.

.2 Welding procedure qualifications shall be in accordance paragraph 127.1.1 of ANSI B31.1 (refer to Section IX of the ASME Boiler and Pressure Vessel Code).

.3 Pressure and leak tests shall conform to paragraph 137 of ANSI B31.1.

.4 Welding safety requirements shall be in accordance with ANSI Z49.1, Safety in Welding and Cutting.

.5 The testing of welding procedures, welders and welding operators shall conform to the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.

.6 Fabricated piping dimensional tolerances and bends shall conform to the “Pipe Fabrication Institute Standard ES3”.

.7 Erected pipelines may have a dimensional tolerance of ½” (13 mm). Greater deviations from drawings are only permissible with written approval from the Contract Administrator.

.8 Piping supports, hangers, spacers, etc. shall be as indicated and in conformance with ANSI B31, Part 5.

3.4 INSTALLATION REQUIREMENTS

.1 Identify each weld with welder's identification symbol.

.2 Backing rings:

- .1 Where used, fit to minimize gaps between ring and pipe bore.
- .2 Do not install at orifice flanges.

.3 Fittings:

- .1 Branch connections: install welding tees or forged branch outlet fittings.

3.5 INSPECTION AND TESTS - GENERAL REQUIREMENTS

.1 Review weld quality requirements and defect limits of applicable codes and standards with Contract Administrator before work is started.

.2 Formulate "Inspection and Test Plan" in co-operation with Contract Administrator.

.3 Do not conceal welds until they have been inspected, tested and approved by inspector.

.4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.

3.6 SPECIALIST EXAMINATIONS AND TESTS

.1 Refer to Section 21 05 01 General Provisions – Mechanical.

.2 Visual examinations: include entire circumference of weld externally and wherever possible internally.

3.7 REPAIR OF WELDS WHICH FAILED TEST

.1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

3.8 CLEANING

.1 Clean in accordance with Section 21 05 01 General Provisions – Mechanical.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B40.100, Pressure Gauges and Gauge Attachments.
.2 ASME B40.200, Thermometers, Direct Reading and Remote Reading.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-14.4, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.
.2 CAN/CGSB-14.5, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

.3 Efficiency Valuation Organization (EVO)

.1 International Performance Measurement and Verification Protocol (IPMVP)

.4 Green Seal Environmental Standards (GS)

.1 GS-11, Standard for Paints and Coatings
.2 GS-36, Standard for Commercial Adhesives

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for thermometers and pressure gauges and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Submit shop:

.1 Submit shop drawings in accordance with Section 21 05 01 General Provisions – Mechanical.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Test and Evaluation Reports:

.1 Submit certified test reports for thermometers and pressure gauges from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store thermometers and pressure gauges off ground, indoors and in a dry location in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.4 Store and protect thermometers and pressure gauges from nicks, scratches, and blemishes.

.5 Replace defective or damaged materials with new.

PART 2 PRODUCTS

2.1 GENERAL

.1 Design point to be at mid-point of scale or range.

.2 Ranges: as indicated.

2.2 PRESSURE GAUGES

.1 General:

.1 Gauge sizes:

.1 1-1/2” NPS and under: 2-1/2” diameter dial.

.2 2” NPS and above: 4” diameter dial.

.2 Scale: gauge ranges should be selected to show twice the normal operating pressure.

.3 All gauges located overhead shall be a minimum of 6” (150mm) diameter and shall be positioned so that they are readable from floor level.

.4 On devices such as pumps, strainers, coils, etc., where the differential pressure is the desired information, install only one pressure gauge with valved connections to the upstream and downstream pressure taps.

.2 Hydronic & compressed air service:

.1 Type: Liquid Filled
.2 Fill Fluid: Glycerin, 20°F (-6.7°C) – 150°F (65.6°C) ambient
.3 Material: Stainless Steel Case
.4 Min. Accuracy: 2 – 3%
.5 Connection: ¼” (6 mm) NPT

.3 Steam service:

.1 Type: Dry with stainless steel pressure snubber

.2 Material: Stainless Steel Case
.3 Min. Accuracy: 2 – 3%
.4 Connection: ¼" (6 mm) NPT

.4 Provide isolation ball valve on all pressure gauge connections, no petcocks.

.5 Acceptable Manufacturer: Ashcroft, Trerice or Approved Equal in accordance with frontend clause B6

2.3 DIRECT READING THERMOMETERS

.1 Requirements:

.1 Size: 3" (76 mm) diameter dial, 4" (102 mm) Stem length
.2 Type: Silicone liquid filled, Variable Angle
.3 Material: Stainless Steel Case and Stem
.4 Connection: ½" (13 mm) NPT
.5 Scale: 32 – 250°F (0 – 121°C) range

.2 Acceptable Product: Ashcroft EL Series or Approved Equal in accordance with frontend clause B6

2.4 THERMOMETER WELLS

.1 To suit pipe material and process connection size.

PART 3 EXECUTION

3.1 GENERAL

.1 Install gauges so they can be easily read from floor or platform.

.2 Install between equipment and first fitting or valve.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet

3.3 THERMOMETERS

.1 Install in wells on piping. Provide heat conductive material inside well.

.2 Install in locations as indicated and on inlet and outlet of:

.1 Heat Exchangers,
.2 Water heating and cooling coils,
.3 Water boilers,
.4 Chillers,
.5 Cooling towers,
.6 DHW tanks.

.3 Install wells for balancing purposes.

.4 Use extensions where thermometers are installed through insulation.

3.4 PRESSURE GAUGES

.1 Install in locations as indicated and:

.1 Suction and discharge of pumps,
.2 Upstream and downstream of PRV's,
.3 Upstream and downstream of three-way control valves,
.4 Inlet and outlet of coils,
.5 Inlet and outlet of liquid side of heat exchangers,
.6 Outlet of boilers.

.2 Use extensions where pressure gauges are installed through insulation.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by thermometer and gauge installation.

3.6 CLEANING

.1 Proceed in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

- .1 ASME B31.1, Power Piping.
- .2 ASME B31.3, Process Piping.
- .3 ASME B31.9, Building Services Piping.

.2 ASTM International

- .1 ASTM A 125, Standard Specification for Steel Springs, Helical, Heat-Treated.
- .2 ASTM A 307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .3 ASTM A 563, Standard Specification for Carbon and Alloy Steel Nuts.

.3 Factory Mutual (FM)

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

- .1 MSS SP 58, Pipe Hangers and Supports – Materials, Design and Manufacture.
- .2 MSS SP 69, Pipe Hangers and Supports – Selection and Application.
- .3 MSS SP 89, Pipe Hangers and Supports – Fabrication and Installation Practices.

.5 Underwriter's Laboratories of Canada (ULC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Product Data:

- .1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

- .1 Submit shop drawings and product data in accordance with Sections 21 05 01 General Provisions – Mechanical.
- .2 Submit shop drawings for the following items:
  - .1 Upper Attachment
  - .2 Middle Attachment
  - .3 Lower Attachment

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Manufacturers' Instructions:

.1 Provide manufacturer's installation instructions.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 21 05 01 General Provisions – Mechanical.

1.4 DELIVERY. STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 21 05 01 General Provisions – Mechanical.

Part 2 PRODUCTS

2.1 GENERAL

.1 Fabricate bases, hangers and supports in accordance with the codes and standards noted in Section 1.1.

.2 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.3 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.4 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP-58.

.5 Use components for intended design purpose only. Do not use for rigging or erection purposes.

.6 Seismic Bracing:

.1 Seismic anchors and bracing for all piping, ductwork and equipment shall be designed by the Contractor. Shop drawings shall be provided for each scenario, and shall be signed and sealed by an Contract Administrator licensed to practice in the project jurisdiction.

2.2 UPPER ATTACHMENTS

.1 Surface Mount on Concrete:

.1 Hot-dip galvanized carbon steel concrete clevis plate. Sizes 3/8” (9.5 mm) through 1” (25.4 mm) supplied with bolt and nut. Larger than 1” (25.4 mm) supplied with pin and cotters.

.1 Acceptable Product: Anvil Fig. 49.

.2 Drilled concrete inserts (four per hanger).
.3 Weldless Eye Nut: Zinc-plated forged steel.
.1 Acceptable Product: Anvil Fig. 290/290L.

.2 Drilled Concrete Inserts:

.1 Flanged, carbon steel internally threaded machine bolt anchor. Tested in accordance with ASTM E 488.
.2 Acceptable Product: Dewalt Steel Dropin.

.3 Suspension from lower flange of I-Beam:

.1 NPS 2" (50 mm) and smaller:

.1 Malleable iron C-clamp with hardened steel cup point, setscrew and locknut. To MSS SP-69 and MSS SP-58 (Type 23), ULC and FM approved.

.1 Acceptable Product: Anvil Fig. 86.

.2 Hot-dip galvanized carbon steel retaining clip. Length of retaining strap to allow at least 1" (25.4 mm) of strap bent over the bottom flange.

.1 Acceptable Product: Anvil Fig. 89.

.2 NPS 2-1/2" (63 mm) and larger:

.1 Hot-dip galvanized carbon steel heavy duty beam clamp with zinc plated fasteners. To MSS SP-69 and MSS SP-58 (Type 21).

.1 Acceptable Product: Anvil Fig. 134

.2 Zinc-plated forged steel weldless eye nut. To MSS SP-69 and MSS SP-58 (Type 17).

.1 Acceptable Product: Anvil Fig. 290/290L.

.4 Suspension from Upper Flange of I-Beam:

.1 NPS 2" (50 mm) and smaller:

.1 ductile iron top-of-beam C-clamp with hardened steel cup point, setscrew and locknut. To MSS SP-69 and MSS SP-58 (Type 19 & 23), ULC and FM approved.

.1 Acceptable Product: Anvil Fig. 92

.2 NPS 2-1/2" (63 mm) and larger:

.1 Fabricated carbon steel J-hook, hole drilled to suit hanger rod diameter.

.5 Surface Mount to Wood Beam or Ceiling:

.1 Zinc plated malleable iron, rod threaded ceiling flange. Use with #12 zinc plated steel wood screws.

.1 Acceptable Product: Anvil Fig. 128R.

.6 Attachment to Side of Wood Joists:

.1 Malleable iron side beam clamp. To MSS SP-69 and MSS SP-58 (Type 34), ULC, FM Approved.

.1 Acceptable Product: Anvil Fig. 202

.2 Securement to joist shall use ¼" (6.4 mm) bolt with washer and nut.

2.3 MIDDLE ATTACHMENT

.1 Requirements:

Type:	Threaded Rod with Electro-Galvanized Finish
Material:	Carbon Steel

2.4 PIPE ATTACHMENT

.1 Requirements:

.1 Material to MSS SP 58

.1 Attachments for steel piping: galvanized carbon steel

.2 Attachments for copper piping: copper plated black steel

.3 Use insulation shields for hot pipework

.2 Adjustable Clevis Hanger:

.1 Hot-dip galvanized carbon steel with zinc plated bolts and nuts and vertical adjustment nuts above and below clevis.

.2 Epoxy coated for suspension of stationary copper tubing.

.3 To MSS SP-69 and MSS SP-58 (Type 1), ULC listed

.4 Acceptable Products:

.1 Anvil Fig. 260 (Steel Pipe).

.2 Anvil Fig. 001CTG (Copper Tubing).

.3 Adjustable Steel Yoke & Pipe Roll:

.1 Hot-dip galvanized carbon steel yoke, zinc plated cast iron roll, and zinc plated roll rod and hex nuts.

.2 To MSS SP-69 and MSS SP-58 (Type 43).

.3 Acceptable Product: Anvil Fig. 181.

.4 Adjustable Swivel Ring:

.1 Pre-galvanized, zinc plated carbon steel strap and zinc plated, knurled nut.

.2 Copper plated for suspension of stationary copper tubing

.3 To MSS SP-58 (Type 10), UL listed and FM approved.

.4 For use with uninsulated piping only.

.5 Acceptable Products:

.1 Anvil Fig. 69 (Steel Pipe).

.2 Anvil Fig CT-69 (Copper Tubing).

.5 Trapeze with U-Bolt:

.1 Hot-dip galvanized carbon steel channel assembly.

.1 Acceptable Product: Anvil Fig. 45.

.2 Hot-dip galvanized carbon steel heavy duty steel washer plate and double nut at each threaded rod connection.

.1 Acceptable Product: Anvil Fig. 60.

.3 Zinc electro-galvanized carbon steel U-bolt and hex nuts to secure pipe (loosely) to channel assembly. To MSS SP-69 and MSS SP-58 (Type 24).

.1 Acceptable Product: Anvil Fig. 137.

.6 Trapeze with Pipe Hangers:

.1 Hot-dip galvanized carbon steel trapeze assembly, designed for top loading.

.1 Acceptable Product: Anvil Fig. 46.

.2 Hot-dip galvanized carbon steel heavy duty steel washer plate and double nut at each threaded rod connection.

.1 Acceptable Product: Anvil Fig. 60.

.3 Zinc electro-galvanized carbon steel U-bolt and hex nuts to secure pipe (loosely) to channel assembly. To MSS SP-69 and MSS SP-58 (Type 24).

.1 Acceptable Product: Anvil Fig. 137.

.7 Pipe Stanchion with Adjustable Pipe Saddle & U-Bolt

.1 Stanchion:

.1 Hot-dip galvanized carbon steel schedule 40 pipe, with welded baseplate.

.2 Acceptable Product: Anvil Fig. 63.

.2 Adjustable pipe Saddle & U-Bolt

.1 Cast iron saddle, steel yoke and nuts, steel locknut and special cast iron reducer. Zinc plated finish. To MSS SP-69 and MSS SP-58 (Type 38).

.2 Acceptable Product: Anvil Fig. 265.

.8 Pipe Clamp: (Vertical Piping)

.1 Hot-dip galvanized carbon steel heavy pipe clamp with zinc plated hardware.

.2 To MSS SP-69 and MSS SP-58 (Type 4).

.3 For use with uninsulated piping only.

.4 Acceptable Product: Anvil Fig. 216.

.9 Offset Pipe Clamp: (Horizontal Piping from Wall or Floor)

.1 Hot-dip galvanized carbon steel with zinc plated fasteners.

.2 For use with uninsulated piping only.

.3 Acceptable Product: Anvil Fig. 103.

.10 Roof Supported:

.1 100% recycled rubber, UV resistant base support. 6-1/8" H x 6" W x Length to suit piping arrangement.
.2 1-5/8" x 1-5/8" 14-gauge galvanized steel channel secured to rubber base.
.3 Electrogalvanized steel pipe clamp complete with galvanized fasteners.
.4 Acceptable Product: Mifab C610 support with Unistrut P1109EG pipe clamp.

.11 Insulation Protection Shields or Saddles for Insulated Piping:

.1 Protection Shields: 12" (305 mm) long pre-galvanized carbon steel, to MSS SP-69 and MSS SP-58 (Type 40). Sized to outside diameter of pipe and insulation.

.1 Acceptable Product: Anvil Fig. 167.

.2 Saddles: 12" (305 mm) long curved carbon steel plates with side edges turned up. To MSS SP-69 and MSS SP-58 (Type 39A & 39B). Saddle selected to suit insulation thickness.

.1 Acceptable Product: Anvil Fig. 160 – Fig. 165.

.12 Manufactured Pipe Support with Insulation:

.1 For use with cold water piping requiring an insulation complete with vapor barrier.
.2 Fiberglass insulation to suit insulation thickness noted in Section 23 07 15 Thermal Insulation for Piping.
.3 Polyisocyanurate rigid foam board insulation inserted into the bottom third of the fiberglass insulation.
.4 Heavy duty galvanized shield secured to underside of insulation ASJ.
.5 Acceptable Manufacturer: Shur-Fit Pro-Pipe Supports.

2.5 SHOP AND FIELD-FABRICATED ASSEMBLIES

.1 Steel brackets: In accordance with the requirements of ASME B31.1 and MSS SP 58.

2.6 SUPPLEMENTARY STRUCTURAL MEMBERS

.1 Provide as required for support of piping, anchoring and sway bracing under active loading

.2 Any supplementary structural members shall be hot-dip galvanized.

2.7 EXPANSION JOINTS

.1 Provide prefabricated expansion joints where required for thermal movement.

2.8 RISER CLAMPS

.1 Steel or cast-iron pipe:

.1 Hot-dip galvanized carbon steel and zinc plated fasteners. To MSS SP-69 and MSS SP-58 (Type 42).
.2 Acceptable Product: Anvil Fig. 40.

.2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.

.1 Epoxy coated carbon steel and zinc plated fasteners. To MSS SP-69 and MSS SP-58 (Type 42).
.2 Acceptable Product: Anvil Fig. 008CTG.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

2.9 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel, submit calculations with shop drawings.

2.10 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.11 HOUSE-KEEPING PADS

.1 Provide 4” (102 mm) high (unless otherwise specified on drawings) concrete housekeeping pads for base-mounted equipment; size pads 2” (51 mm) larger than equipment, all sides; chamfer pad edges.

.2 Where tying into existing house keeping pads, Form concrete around existing housekeeping pad to meet requirements listed.

Part 3 EXECUTION

3.1 HANGER SPACING

.1 Spacing and middle attachment diameter as specified in paragraphs below or as found in table below, whichever is more stringent.

.1 Plumbing Piping: most stringent requirements of Canadian Plumbing Code, or authority having jurisdiction
.2 Fire Protection: designed and installed to meet the applicable fire code(s).
.3 Gas Piping: in accordance with CSA B149.1 Natural Gas and Propane Installation Code.
.4 Flexible Joint Roll Groove Pipe: in accordance with table below, but not less than one hanger at joints.
.5 Within 12” (300mm) of each horizontal elbow

Pipe Size NPS (mm)	Maximum Spacing for Steel (Water) ft (m)	Maximum Spacing for Steel (Steam, Gas, or Air) ft (m)	Maximum Spacing for Copper ft (m)	Rod Diameter in. (mm)
Up to 1-1/4 (32)	7 (2.1)	9 (2.7)	6 (1.8)	3/8 (10)
1-1/2 (38)	9 (2.7)	9 (2.7)	8 (2.4)	3/8 (10)
2 (50)	10 (3.0)	13 (4.0)	8 (2.4)	3/8 (10)
2-1/2 (65)	12 (3.7)	15 (4.6)	10 (3.0)	1/2 (13)
3 (75)	12 (3.7)	15 (4.6)	10 (3.0)	1/2 (13)
3-1/2 (90)	13 (4.0)	17 (5.2)	11 (3.4)	1/2 (13)
4 (100)	14 (4.3)	17 (5.2)	12 (3.7)	5/8 (16)
5 (125)	16 (4.9)	21 (6.4)	-	5/8 (16)
6 (150)	17 (5.2)	21 (6.4)	-	7/8 (22)
8 (200)	19 (5.8)	24 (7.3)	-	7/8 (22)
10 (250)	22 (6.1)	30 (9.1)	-	7/8 (22)
12 (300)	23 (7.0)	30 (9.1)	-	7/8 (22)

3.2 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

.4 Paint all supplementary support steel as noted in Section 21 05 01 General Provisions – Mechanical.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.

1.2 REFERENCES

.1 Canadian Gas Association (CGA)

.1 CSA/CGA B149.1, Natural Gas and Propane Installation Code.
.2 CSA B128.1/CSA B128.2 Design and Installation of Non-Potable Water Piping Systems / Maintenance and Field Testing of Non-Potable Water Systems.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.
.2 CAN/CGSB-24.3, Identification of Piping Systems.

.3 National Fire Protection Association (NFPA)

.1 NFPA 13, Standard for the Installation of Sprinkler Systems
.2 NFPA 14, Standard for the Installation of Standpipe and Hose Systems

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submittals: in accordance with Sections 21 05 01 General Provisions – Mechanical.
.2 Product data to include paint color chips, other products specified in this section.

.2 Samples:

.1 Submit samples in accordance with Sections 21 05 01 General Provisions – Mechanical.
.2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.4 QUALITY ASSURANCE

.1 Quality assurance submittals: submit following in accordance with Sections 21 05 01 General Provisions – Mechanical.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Refer to Sections 21 05 01 General Provisions – Mechanical.

Part 2 PRODUCTS

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers raised or recessed.

.3 Information to include, as appropriate:

.1 Equipment: manufacturer's name, model, size, serial number, capacity.
.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:

.1 Hazardous: red letters, white background.
.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 100	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Terminal cabinets, control panels: use size # 5.
.2 Equipment in Mechanical Rooms: use size # 9.

2.3 EXISTING IDENTIFICATION SYSTEMS

.1 Apply existing identification system to new work.

.2 Where existing identification system does not cover for new work, use identification system specified this section.

.3 Before starting work, obtain written approval of identification system from Contract Administrator.

2.4 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification:

.1 Natural gas: to CSA/CGA B149.1.

.2 Propane gas: to CSA B149.1.

.1 Sprinklers: to NFPA 13.
.2 Standpipe and hose systems: to NFPA 14.
.3 Non-potable water systems: to CSA B128.1

2.5 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

.2 Pictograms:

.1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Pipe Marker & Text Size:

.1 In accordance with CAN/CGSB 24.3:

Outside Diameter of Pipe or Covering	Minimum Letter and Number Height	Length of Pipe Label
¾” to 1-1/4”	1/2”	8”
1-1/2” to 2”	3/4”	8”
2-1/2” to 6”	1-1/4”	12”
8” to 10”	2-1/2”	24”
Over 10”	3-1/2”	32”

.4 Label Marker and Banding:

.1 Label marker: To ANSI A13.1, self-sticking vinyl pipe marker, factory applied industrial grade adhesive, providing banding at each end of pipe marker with arrow tape to secure markers to pipe.
.2 Banding: Self-sticking vinyl tape complete with directional flow arrows, factory applied industrial grade adhesive. Install banding with arrows

pointing in the direction of flow. Banding shall overlap label marker and make 1.5 passes around circumference of pipe.

.5 Colours and Legends:

.1 Where not listed, obtain direction from Contract Administrator.

.2 Colours for legends, arrows: to following table:

Background colour	Legend arrows
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
City water	Green	CITY WATER
Condenser water supply	Green	COND. WTR. SUPPLY
Condenser water return	Green	COND. WTR. RETURN
Chilled water supply	Green	CH. WTR. SUPPLY
Chilled water return	Green	CH. WTR. RETURN
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
Make-up water	Yellow	MAKE-UP WTR
Boiler feed water	Yellow	BLR. FEED WTR
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Storm water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Fire protection water	Red	FIRE PROT. WTR
Sprinklers	Red	SPRINKLERS

2.6 IDENTIFICATION DUCTWORK SYSTEMS

.1 2” (50 mm) high stenciled letters and directional arrows 6” (150 mm) long x 2” (50 mm) high.

.2 Colours: back, or coordinated with base colour to ensure strong contrast.

2.7 VALVES, CONTROLLERS, & EQUIPMENT

.1 Valves:

.1 Brass tags with ½” (13 mm) stamped identification data filled with black paint.

.2 Controllers & Equipment:

.1 Black limacoid with white lettering, per Section 2.2 System Nameplates.

.3 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.8 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

2.9 LANGUAGE

.1 Identification in English.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 TIMING

.1 Provide identification only after painting has been completed.

3.3 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Provide ULC and/or CSA registration plates as required by respective agency.

3.4 NAMEPLATES

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:

.1 Do not paint, insulate or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 55 ft (17 m) intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification easily and accurately readable from usual operating areas and from access points.

.1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

.10 Non-Potable Water piping:

.1 Non-potable water piping: at not more than 5 ft (1.5 m) intervals and more frequently if required to ensure that at least one is visible from any one viewpoint.

.2 Buried piping shall be identified with a permanent warning tape installed at least 12” (300 mm) above the pipe, running lengthwise. In addition, a tracer wire shall be installed for non-metallic pipes.

3.6 VALVES, CONTROLLERS, & EQUIPMENT

.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Equipment such as boilers, chillers, air handlers, and terminal equipment such as fan coils, VAVs, heat pumps, etc. shall be provided with lamacoids to identify their tag number.

.3 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed Contract Administrator. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.4 Number valves in each system consecutively.

3.7 CLEANING

.1 Proceed in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do all other work as specified in this section.

.2 TAB to be performed by balancing company who is a registered member of AABC and final TAB report shall bear seal and certification number of AABC registration.

1.2 QUALIFICATIONS OF TAB PERSONNEL

.1 TAB; performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:

.1 Associated Air Balance Council, (AABC) National Standards for Total System Balance.

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing.

.2 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.3 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.4 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.5 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

1.3 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.

.2 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match design conditions.

1.4 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.5 PRE-TAB REVIEW

.1 Review Contract Documents before project construction is started and confirm adequacy of provisions for TAB and all other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Contract Administrator all proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of all TAB devices, equipment, accessories, measurement ports and fittings.

1.6 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Divisions 21 & 23.

1.7 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Contract Administrator for verification of TAB reports.

1.8 START OF TAB

.1 Notify Contract Administrator 7 days prior to start of TAB.

.2 Start TAB only when building is essentially completed including:

.1 Installation of ceilings, doors, windows, other construction affecting TAB.
.2 Application of weatherstripping, sealing, caulking.
.3 All pressure, leakage, other tests specified elsewhere in Divisions 21 & 23.
.4 All provisions for TAB installed and operational.
.5 Start-up, verification for proper, normal and safe operation of all mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air Systems:

.1 Filters in place, clean.

.2 Duct systems clean.

.3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.

.4 Correct fan rotation.

.5 Fire, smoke, volume control dampers installed and open.

.6 Coil fins combed, clean.

.7 Access doors, installed, closed.

.8 Outlets installed, volume control dampers open.

.3 Liquid systems:

.1 Flushed, filled, vented.

.2 Correct pump rotation.

.3 Strainers in place, baskets clean.

.4 Isolating and balancing valves installed, open.

.5 Calibrated balancing valves installed, at factory settings.

.6 Chemical treatment systems complete, operational.

1.9 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 Laboratory HVAC Systems: plus 10%, minus 0%
.2 HVAC systems: plus 5%, minus 5%.
.3 Hydronic systems: plus 10%, minus 10%.

1.10 ACCURACY TOLERANCES

.1 Measured values to be accurate to within plus or minus 2% of actual values.

1.11 INSTRUMENTS

.1 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.2 Calibrate within 3 months of TAB.

1.12 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit, prior to commencement of TAB:

.1 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.13 TAB REPORT

.1 TAB report to show all results in Imperial units and to include:

.1 Project record drawings.
.2 System schematics.
.3 Date of TAB, date of report.

.2 Submit copy of TAB Report to Contract Administrator for verification and approval, in English in PDF format.

.3 Incorporate review comments and submit final TAB report in PDF format. Include in project O&M manual described in Section 21 05 01 General Provisions - Mechanical.

1.14 VERIFICATION

.1 Reported results subject to verification by Contract Administrator.

.2 Provide personnel and instrumentation to verify up to 100% of the reported results.

.3 Number and location of verified results as directed by Contract Administrator.

.4 Pay associated costs (labor, travel, accommodations, etc.) as required to repeat TAB measurements to satisfaction of Contract Administrator.

1.15 SETTINGS

.1 After TAB is completed to satisfaction of Contract Administrator, replace drive guards, close all access doors, lock all devices in set positions, ensure sensors are at required settings.

.2 Permanently mark all setting to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

1.16 COMPLETION OF TAB

.1 TAB to be considered complete only when final TAB Report received and approved by Contract Administrator.

1.17 AIR SYSTEMS

.1 Standard TAB to be to most stringent of TAB standards of AABC or ASHRAE.

.2 Do TAB of following systems, equipment, and components including all grilles, dampers and zone pressurization unless otherwise stated.

.1 New air handling unit, AHU-1
.2 New energy recovery ventilator, ERV-1
.3 New fan coils, FC
.4 New supply air diffusers
.5 New exhaust grilles
.6 New fire dampers.

.3 Measurements: to include, but not limited to, the following as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb), duct cross-sectional area, RPM electrical power.

.4 Locations of equipment measurements; to include, but not limited to, the following as appropriate:

.1 Outlet of each damper, grille, terminal unit and fan.
.2 At controllers, controlled device.

.5 Locations of systems measurements to include, but not be limited to, following as appropriate: each main duct, main branch, sub-branch, run-out (or grille, register or diffuser).

1.18 HYDRONIC SYSTEMS

.1 Standard TAB to be to most stringent of TAB standards of AABC or ASHRAE.

.2 Do TAB of following systems, equipment, and components including all end devices within the following systems.

.1 Boiler circulation pumps: BP-01 & BP-02
.2 Main hot water distribution pumps: CP-01 & CP-02
.3 Glycol pumps: GP-01 & GP-02
.4 Chilled water pumps: CHP-01 & CHP-02
.5 Boilers: B-01 & B-02
.6 Chiller: CH-01
.7 All new balance valves installed under this Contract.

.3 Measurements: to include, but not limited to, the following as appropriate for systems, equipment, components, controls: velocity, head pressure, flow rate, pressure drop (or loss), temperatures (supply/return), RPM electrical power.

.4 Locations of equipment measurements; to include, but not limited to, the following as appropriate:

.1 Outlet of each pump, boiler, coil and control valve.

.5 Locations of systems measurements to include, but not be limited to, following as appropriate: each main pipe, main branch, sub-branch, run-out.

Part 2 PRODUCTS

.1 Not Used.

Part 3 EXECUTION

.1 Not Used.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ANSI/ASHRAE/IESNA 90.1, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 ASTM International Inc.

.1 ASTM B 209M, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
.2 ASTM C 335, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
.3 ASTM C 411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
.4 ASTM C 449/C 449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
.5 ASTM C 547, Standard Specification for Mineral Fiber Pipe Insulation.
.6 ASTM C 553, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
.7 ASTM C 612, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
.8 ASTM C 795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
.9 ASTM C 921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation

.3 American National Standards Institute (ANSI) / National Fire Protection Association (NFPA)

.1 ANSI/NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems
.2 ANSI/NFPA 90B Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

.4 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.5 Green Seal Environmental Standards (GSES)

.1 Standard GS-36, Commercial Adhesives.

.6 Thermal Insulation Association of Canada (TIAC): National Insulation Standards

.7 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
.2 CAN/ULC-S701, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
.3 CAN/ULC-S704.1, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced.

1.2 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" – insulated mechanical services and equipment tin suspended ceilings and non-accessible chases and furred-in spaces.
.2 "EXPOSED" – will mean "not concealed" as defined herein.
.3 Insulation Systems – insulation material, fasteners, jackets, and all related accessories required for a complete installation.

.2 TIAC Codes:

.1 CRD: Code Round Ductwork,
.2 CRF Code Rectangular Finish.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals: in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 21 05 01 General Provisions – Mechanical. Include product characteristics, performance criteria, and limitations.

.3 Shop Drawings:

.1 Submit shop drawings in accordance with Section 21 05 01 General Provisions – Mechanical.

.4 Manufacturers' Instructions:

.1 Provide manufacture's written duct insulation jointing recommendations. and special handling criteria, installation sequence, cleaning procedures.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project, member of TIAC.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 21 05 01 General Provisions – Mechanical.
.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
.3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Storage and Protection:

.1 Protect from weather, construction traffic.
.2 Protect against damage.
.3 Store at temperatures and conditions required by manufacturer.

Part 2 PRODUCTS

2.1 FIRE AND SMOKE RATING

.1 To CAN/ULC-S102

.1 Maximum flame spread rating: 25.
.2 Maximum smoke developed rating: 50.

.2 To CAN/ULC-S102

.1 Maximum flame spread rating: 0 (TIAC Code CEF/2).
.2 Maximum smoke developed rating: 0 (TIAC Code CEF/2).

2.2 INSULATION

.1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 74°F (24°C) mean temperature when tested in accordance with ASTM C 335.

.3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket and reinforced kraft paper all service jacket.

.1 Mineral fibre: to CAN/ULC-S702.
.2 Maximum "k" factor: to CAN/ULC-S702.

.4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket and reinforced kraft paper all service jacket.

.1 Mineral fibre: to CAN/ULC-S702.
.2 Jacket: to CGSB 51-GP-52Ma.
.3 Maximum "k" factor: to CAN/ULC-S702.

.5 TIAC Code C-1: rigid mineral fibre board without factory applied vapour retarder jacket.

.1 Mineral fibre: ASTM C 612.
.2 Maximum “k” factor: ASTM C 612.

.6 TIAC Code C-4: rigid mineral fibre board faced with factory applied vapour retarder jacket:

.1 Mineral fibre: ASTM C 612.
.2 Jacket: to CGSB 51-GP-52MA.
.3 Maximum "k" factor: ASTM C 612.

.7 TIAC Code C-2: mineral fibre blanket faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).

.1 Mineral fibre: to ASTM C 553
.2 Jacket: to CGSB 51-GP-52Ma
.3 Maximum "k" factor: to ASTM C 553

.8 TIAC Code C-7: uniform closed-cell polyisocyanurate foam board core bonded on each side with a foil facer.

.1 Polyisocyanurate: to CAN/ULC-S704.1.
.2 Maximum "k" factor: to CAN/ULC-S704.1

.9 TIAC Code A-2: rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.

.1 Insulation: to ASTM C 533.
.2 Maximum "k" factor: ASTM C 533
.3 Design to permit periodic removal and re-installation.

.10 TIAC Code CEF/2: fire resistant inorganic fibre blanket encapsulated with scrim-reinforced foil.

.1 Insulation: to ASTM C 411, ASTM C51, ASTM E 84, UL 1978.
.2 Maximum "k" factor: ASTM C 411
.3 On round ducts and on rectangular ducts 740mm or less in width, no preparation is necessary. On rectangular ducts 600mm or more in width, apply to bottom surface, either mechanical fasteners at approximately 300 mm centres, or insulation adhesive applied in strips 100mm wide on approximately 300 mm centres.

2.3 JACKETING

.1 Polyvinyl Chloride (PVC):

.1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.
.2 Colours: to match adjacent finish paint.
.3 Minimum service temperatures: -20°C.
.4 Maximum service temperature: 65°C.
.5 Moisture vapour transmission: 0.02 perm.
.6 Thickness: 1.6 mm.
.7 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

.2 Aluminum:

.1 Zero permeability, multi-layered, reinforced laminate coated with cold weather acrylic adhesive. Adhesive application down to -10°F (-23°C).
.2 Thickness: 0.61 mm sheet.
.3 Colour: Natural Aluminum.
.4 Finish: embossed.
.5 Service Temperature: -94°F - 248°F (-70°C - 120°C).
.6 Puncture: 68 lbs.
.7 Acceptable Product: 3M VentureClad, series 1579CONTRACTORW-E.

.3 Canvas:

.1 220 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
.2 Lagging adhesive: compatible with insulation.
.3 Colour: confirm with Contract Administrator prior to installation.

.4 CRF/1 Indoor Canvas:

.1 Use over rigid insulation with an integral vapour retarder. vapour Apply continuous metal corner bead to all corners. Adhere vapour retarder tape over all joints and breaks in vapour retarder, and at all corn
.2 Secure canvas jacket over insulation using fire resistive lagging coating and adhesive, and finish with one (1) coat of fire resistive lagging coating adhesive.

2.4 ACCESSORIES

.1 Vapour retarder lap adhesive:

.1 Water based, fire retardant type, compatible with insulation.

.2 Indoor Vapour Retarder Finish:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C 449.

.4 Outdoor Vapour Retarder Mastic:

.1 Vinyl emulsion type acrylic, compatible with insulation.
.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m^2.

.5 Tape: self-adhesive, aluminum, reinforced, 75 mm wide minimum.

.6 Contact adhesive: quick-setting.

.7 Canvas adhesive: washable.

.8 Tie wire: 1.5 mm stainless steel.

.9 Banding: 19 mm wide, 0.5 mm thick stainless steel.

.10 Facing: 25 mm galvanized steel hexagonal wire mesh stitched on both faces of insulation.

.11 Fasteners: 4 mm diameter pins with 35 mm diameter clips, length to suit thickness of insulation.

Part 3 EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PRE-INSTALLATION REQUIREMENTS

.1 Pressure test ductwork systems complete (if required), witness and certify.

.2 Ensure any other required tests have been completed and approved by Contract Administrator.

.3 Ensure surfaces are clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards and ANSI/NFPA 90A and ANSI/NFPA 90B.

.2 Apply insulation materials, accessories and finishes in accordance with manufacturer’s recommendations and as specified. Adhere and seal vapor barrier using vapor seal adhesives.

.3 Use no less than 2 layers of insulation with staggered joints when required nominal thickness exceeds 75 mm.

.4 Vapour barriers and insulation to be unbroken over full length of duct or surface, without penetration for hangers, standing duct seams and without interruption at sleeves and supports. Insulate strap hangers 100 mm beyond insulated duct.

.5 Use stand-offs for duct mounted control accessories.

.6 Apply 1 mm thick galvanized sheet metal corners (nosings) in traffic areas to ductwork in mechanical rooms.

.7 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum two rows each side.

.8 Where PVC jackets are installed on round ductwork, rigid molded insulation shall be used.

3.4 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses: conform to following table.

Duct System	Round		Rectangular		Insulation Thickness (in.)
	Warm	Cold	Warm	Cold	
Indoor Ductwork					
Supply Air	A-1, C-2	A-3, C-2	C-1, C-2	C-2, C-4	1.5
Return Air	A-1, C-2	A-3, C-2	C-1, C-2	C-2, C-4	-
Outdoor/Combustion Air	A-1, C-2	A-3, C-2	C-1, C-2	C-2, C-4	2
Exhaust/Relief Air	A-1, C-2	A-3, C-2	C-1, C-2	C-2, C-4	1.5
Exterior Ductwork					
Supply Air	A-3	A-3	C-7	C-7	5
Return Air	A-3	A-3	C-7	C-7	5

.2 The table above shall be supplemented with the following notes:

.1 Ductwork carrying conditioned air and installed outdoors needs to be insulated to same level as building wall. Provide thickness noted above unless noted otherwise.

.2 Rigid board insulation shall be used on ductwork larger than 48” wide or tall. Blanket insulation shall be used otherwise.

.3 Exposed round ductwork requiring jacket shall be provided with rigid molded insulation.

.4 Exposed rectangular ductwork requiring jacket shall be provided with rigid board insulation.

.5 Exhaust air, relief air, and return air ductwork connected to outdoors shall be insulated 10 ft back from outside wall / roof or until the first motorized damper, whichever is longer.

.6 Where insulation is installed up to equipment requiring clearances to combustibles, non-combustible insulation shall be installed in the clearance space.

.7 If motorized dampers on ductwork communicating with outside are not installed in the same plane as the exterior wall, all ductwork between the exterior wall and motorized damper needs to be insulated to the same degree as the building envelope using fiberglass insulation.

.3 Finishes:

.1 Exposed indoors:

.1 Round: PVC jacket.

.2 Rectangular: Canvas jacket.

.2 Exposed in mechanical rooms:

.1 Round: foil scrim kraft (FSK) facing. No further finish.

.2 Rectangular: foil scrim kraft (FSK) facing. No further finish.

.3 Concealed, indoors: foil scrim kraft (FSK) facing. No further finish.

.4 Outdoors: water-proof aluminum jacket.

.5 Finish attachments: SS bands, at 150 mm on centre. Seals: closed.

.6 Installation: to appropriate TIAC code:

.1 Round: CRD/2 to CRD/5

.2 Rectangular: CRF/1 to CRF/4

3.5 CLEANING

.1 Proceed in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ANSI/ASHRAE 90.1-SI Edition, Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 ASTM International Inc.

.1 ASTM C 335, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
.2 ASTM C 449/C 449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
.3 ASTM C 533, Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
.4 ASTM C 547, Standard Specification for Mineral Fiber Pipe Insulation.
.5 ASTM C 553, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
.6 ASTM C 612, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
.7 ASTM C 795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
.8 ASTM C 921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52MA, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
.2 CAN/CGSB 51.53, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.5 Thermal Insulation Association of Canada (TIAC)

.1 National Insulation Standards 2005.

.6 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide two copies WHMIS MSDS - Material Safety Data Sheets.

.3 Manufacturer's Instructions:

.1 Include procedures to be used and installation standards to be achieved.

.4 Qualifications:

.1 Installer to be specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Manufacturer's literature.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Store at temperatures and conditions recommended by manufacturer.

Part 2 PRODUCTS

2.1 GENERAL

.1 Fire and smoke ratings to CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre: includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C 335.

.3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.

.1 Mineral fibre: to ASTM C 547.

.2 Maximum "k" factor: to CAN/ULC-S702.

.4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: to ASTM C 547.
.2 Jacket: to CGSB 51-GP-52Ma.
.3 Maximum "k" factor: to CAN/ULC-S702.

.5 TIAC Code C-1: rigid mineral fibre board, unfaced.

.1 Mineral fibre: ASTM C 612
.2 Maximum “k” factor: ASTM C 612

.6 TIAC Code C-4: rigid mineral fibre board faced with factory applied vapour retarder jacket:

.1 Mineral fibre: ASTM C 612.
.2 Jacket: to CGSB 51-GP-52MA.
.3 Maximum "k" factor: ASTM C 612.

.7 TIAC Code C-2: mineral fibre blanket faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).

.1 Mineral fibre: to ASTM C 553.
.2 Jacket: to CGSB 51-GP-52Ma.
.3 Maximum "k" factor: to ASTM C 553.

.8 TIAC Code A-6: flexible unicellular tubular elastomer.

.1 Insulation: with vapour retarder jacket.
.2 Jacket: to CGSB 51-GP-52Ma.
.3 Certified by manufacturer: free of potential stress corrosion cracking corrodents.

.9 TIAC Code A-2: rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.

.1 Insulation: to ASTM C 533.
.2 Maximum "k" factor: ASTM C 533
.3 Design to permit periodic removal and re-installation.

2.3 CEMENT

.1 Thermal insulating and finish

.1 To: ASTM C 449/C 449M.
.2 Hydraulic setting on mineral wool, to ASTM C 449.

2.4 JACKETS

.1 Polyvinyl Chloride (PVC):

.1 One-piece moulded type and sheet to CAN/CGSB 51.53 with pre-formed shapes as required.

.2 Colours: to match adjacent finish paint.
.3 Minimum service temperatures: -20 degrees C.
.4 Maximum service temperature: 65 degrees C.
.5 Moisture vapour transmission: 0.02 perm.
.6 Fastenings:
.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Canvas:

.1 220 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.
.2 Lagging adhesive: compatible with insulation.

.3 Aluminum:

.1 To ASTM B 209.
.2 Thickness: 0.50mm sheet.
.3 Finish: stucco embossed.
.4 Joining: longitudinal and circumferential slip joints with 50 mm laps.
.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

.4 Stainless Steel (SS):

.1 Type: 316.
.2 Thickness: 0.4 mm.
.3 Finish: stucco embossed.
.4 Joining: longitudinal and circumferential slip joints with 50 mm laps.
.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

2.5 INSULATION SECUREMENTS

.1 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.

.2 Contact adhesive: quick setting.

.3 Canvas adhesive: washable.

.1 Maximum VOC limit 30 80 250 g/L to SCAQMD Rule 1168 GSES GS-36 and in accordance with Section 01 35 21 - LEED Requirements.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.

.6 Facing: 25 mm galvanized steel hexagonal wire mesh on one face both faces of insulation on one face of insulation with expanded metal lath on other face.

.7 Fasteners: 2 4 mm diameter pins with 35 mm diameter square clips. Length of pin to suit thickness of insulation.

2.6 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.7 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.8 OUTDOOR VAPOUR RETARDER MASTIC

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m^2.

Part 3 EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PRE- INSTALLATION REQUIREMENTS

.1 Pressure testing of equipment and adjacent piping systems complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards

.1 Hot equipment: To TIAC code 1503-H.
.2 Cold equipment: to TIAC code 1503-C.

.2 Elastomeric Insulation: to remain dry. Overlaps to manufacturer's instructions. Joints tight and sealed properly.

.3 Provide vapour retarder as recommended by manufacturer.

.4 Apply materials in accordance with insulation and equipment manufacturer's instructions and this specification.

.5 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.6 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports outside vapour retarder jacket.

.7 Supports, Hangers:

.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: At expansion joints, valves, flanges and unions at equipment. Removable insulation enclosures are *not* permitted on equipment flowing chilled water.

.2 Installation to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

3.5 EQUIPMENT INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 Hot Equipment

.1 TIAC code A-1 (round equipment) or C-1 (rectangular equipment) with mechanical fastenings or bands.

.2 Thicknesses:

Equipment	TIAC Code	Thickness
Heat exchangers	C-1	50 mm

.3 Breechings, engine exhausts and mufflers:

.1 TIAC code A-2 with 25 mm air gap, mechanical fastenings or bands and 13 mm cement reinforced with one layer of reinforcing mesh.

.4 Cold equipment:

.1 TIAC code A-3 (round equipment), C-4 (rectangular equipment), or A-6 (preformed) with mechanical fastenings or bands.

.1 Equipment insulated with TIAC code A-6 insulation shall be hand molded and formed by the installer to follow the geometry and contours of the equipment being insulated.

.2 Thicknesses:

Equipment	TIAC Code	Thickness
Chiller, integral piping and heat exchangers (except factory insulated)	A-3	50 mm
Air separators	A-3	50 mm
Hydraulic separators	A-3	50 mm
Buffer tanks	A-3	50 mm
Heat exchangers	C-4	50 mm
Pump Volute	A-6	50 mm

.5 Finishes:

.1 Engine exhaust piping and muffler: To TIAC code CRF/3

.1 Adhere vapour retarder tape over all joints and breaks in vapour retarder and at all corners.

.2 Apply over the insulation surface a stainless-steel jacket secured with pop rivets or stainless-steel self tapping screws. All joints sealed or flashed to prevent water infiltration.

.2 Equipment outdoors: TIAC code CEF/1

.1 Over the insulation, apply aluminum jacket secured with metal banding and mechanical seals.

.3 Equipment indoors: TIAC code CEF/2

.1 Air separators, hydraulic separators:

.1 Finish with a layer of PVC jacket with all joints and seams sealed.

.2 Pump volutes:

.1 No further finish on insulation.

.3 Plate and frame heat exchanger:

.1 No further finish on insulation.

3.6 CLEANING

.1 Clean in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Thermal insulation for piping and piping accessories in commercial type applications.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ASHRAE Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM B 209M, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.
.2 ASTM C 335, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
.3 ASTM C 411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
.4 ASTM C 449/C 449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
.5 ASTM C 533, Calcium Silicate Block and Pipe Thermal Insulation.
.6 ASTM C 547, Mineral Fiber Pipe Insulation.
.7 ASTM C 795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
.8 ASTM C 921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
.2 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.

.4 Department of Justice Canada (Jus)

.1 Canadian Environmental Assessment Act (CEAA), c. 37.
.2 Canadian Environmental Protection Act (CEPA), c. 33.
.3 Transportation of Dangerous Goods Act (TDGA), c. 34.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.6 Manufacturer's Trade Associations

.1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

.7 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
.2 CAN/ULC-S701, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
.3 CAN/ULC-S702, Thermal Insulation, Mineral Fibre, for Buildings
.4 CAN/ULC-S702.2, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.3 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
.2 "EXPOSED" - will mean "not concealed" as specified.
.3 Insulation Systems – insulation material, fasteners, jackets, and all related accessories required for a complete installation.

.2 TIAC Codes:

.1 CRF: Code Rectangular Finish.
.2 CPF: Code Piping Finish.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals: in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 21 05 01 General Provisions – Mechanical. Include product characteristics, performance criteria, and limitations.

.3 Shop Drawings:

.1 Submit shop drawings in accordance with Section 21 05 01 General Provisions – Mechanical.

.4 Quality assurance submittals: submit following in accordance with Section 21 05 01 General Provisions – Mechanical.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
.2 Instructions: submit manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project, member of TIAC.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 21 05 01 General Provisions – Mechanical.
.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
.3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Storage and Protection:

.1 Protect from weather, construction traffic.
.2 Protect against damage.
.3 Store at temperatures and conditions required by manufacturer.

Part 2 PRODUCTS

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102.

.1 Maximum flame spread rating: 25.
.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C 335.

.3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket and reinforced kraft paper all service jacket.

.1 Mineral fibre: to CAN/ULC-S702.
.2 Maximum "k" factor: to CAN/ULC-S702.

.4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket and reinforced kraft paper all service jacket.

.1 Mineral fibre: to CAN/ULC-S702.
.2 Jacket: to CGSB 51-GP-52Ma.
.3 Maximum "k" factor: to CAN/ULC-S702.

.5 TIAC Code C-2: mineral fibre blanket faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).

.1 Mineral fibre: to CAN/ULC-S702.
.2 Jacket: to CGSB 51-GP-52Ma.
.3 Maximum "k" factor: to CAN/ULC-S702.

.6 TIAC Code A-6: flexible unicellular tubular elastomer.

.1 Insulation: with vapour retarder jacket.
.2 Jacket: to CGSB 51-GP-52Ma.
.3 Certified by manufacturer: free of potential stress corrosion cracking corrodents.

.7 TIAC Code A-2: rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.

.1 Insulation: to ASTM C 533.
.2 Design to permit periodic removal and re-installation.

2.3 INSULATION SECUREMENT

.1 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.

.2 Contact adhesive: quick setting.

.3 Canvas adhesive: washable.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: stainless steel, 19 mm wide, 0.5 mm thick.

2.4 CEMENT

.1 Thermal insulating and finishing cement:

.1 Hydraulic setting or Air drying on mineral wool, to ASTM C 449/C 449M.

2.5 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 OUTDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: fibrous glass, untreated 305 g/m^2.

2.8 JACKETS

.1 Polyvinyl Chloride (PVC):

.1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes for pipe fittings and valves as required.
.2 Colours: to match adjacent finish paint.

.3 Minimum service temperatures: -20°C.
.4 Maximum service temperature: 65°C.
.5 Moisture vapour transmission: 0.02 perm.
.6 Thickness: 1.6 mm.
.7 Fastenings:
.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
.2 Tacks.
.3 Pressure sensitive vinyl tape of matching colour.

.2 Aluminum:

.1 To ASTM B 209.
.2 Thickness: 0.50 mm sheet.
.3 Finish: stucco embossed.
.4 Joining: longitudinal and circumferential slip joints with 50 mm laps.
.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing. Screws, rivets and other mechanical fasteners are not permitted.
.7 Acceptable Manufacturer: Johns Mansville or Approved Equal in accordance with frontend clause B6.

2.9 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS

.1 Caulking to: Section 07 92 00 Joint Sealants.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturer’s instructions and this specification.

.3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Install hangers, supports outside vapour retarder jacket.

.5 Flanged and grooved fittings:

.1 Insulate with oversized pipe covering or mitered blocks to the thickness of the adjacent pipe covering. Alternately insulate with tightly placed flexible insulation and apply PVC fitting covers.

.6 Supports, Hangers:

.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: at expansion joints, valves, primary flow measuring elements, flanges and unions at equipment. Removable insulation enclosures are *not* permitted on equipment flowing chilled water.

.2 Design: to permit movement of expansion joint, and to permit periodic removal and replacement without damage to adjacent insulation.

.3 Insulation:

.1 Insulation, fastening and finishes: same as system.
.2 Jacket: same as system.

3.5 INSTALLATION OF ELASTOMERIC INSULATION

.1 Insulation to remain dry. Overlaps to manufacturer's instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

.3 Use pre-fabricated fitting covers provided by insulation manufacturer.

3.6 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 TIAC Code: A-1.

.1 Securements: Tape at 300 mm on centre.
.2 Seals: lap seal adhesive, lagging adhesive.
.3 Installation: TIAC Code 1501-H.

.3 TIAC Code: A-3.

.1 Securements: Tape at 300 mm on centre.
.2 Seals: VR lap seal adhesive, VR lagging adhesive.
.3 Installation: TIAC Code: 1501-C.

.4 TIAC Code: A-6.

.1 Seals: lap seal adhesive, lagging adhesive.

.5 TIAC Code: C-2 with vapour retarder jacket.

.1 Seals: lap seal adhesive, lagging adhesive.
.2 Installation: TIAC Code: 1501-C.

.6 TIAC Code: A-2.

.1 Seals: lap seal adhesive, lagging adhesive.
.2 Installation: TIAC Code: 1501-H.

.7 Thickness of insulation as listed in following table.

.1 Run-outs to individual units and equipment not exceeding 4000 mm long.
.2 Do not insulate exposed chrome plated piping, valves, fittings.

Type of System	Thermal Conductivity of Insulation		TIAC Code	Nominal Pipe Diameter				
	Conductivity Range (W/m·°C)	Mean Rating Temperature (°C)		Runouts ≤ 50	≤ 25	32 to 50	63 to 100	≥ 125
				Minimum thickness of pipe insulation				
Heating Systems (Hot Water and Glycol)	0.036 - 0.042	52	A-1	25	38	50	50	50
Cooling Systems (Chilled Water, Glycol)	0.030 - 0.039	24	A-3	25	25	38	38	38
Cooling Systems (Brine, Refrigerant)	0.030 - 0.039	24	A-6	25	25	38	38	38
Plumbing Systems								
Conditioned Space								
Domestic cold Water	0.035 - 0.040	38	A-3	25	25	25	38	38
Hot Water	0.035 - 0.040	38	A-1	25	25	25	38	38
Tempered Water	0.035 - 0.040	38	A-1	25	25	25	38	38
Hot Water Recirculation	0.035 - 0.040	38	A-1	25	25	25	38	38
Plumbing Vents	0.046 - 0.049	38	A-3	25	25	25	25	25
Rain Water Leaders / Storm Water	0.035 - 0.040	38	A-3	25	25	25	25	25

.8 Grooved Pipe Coupling Insulation (cold water piping only):

.1 Pipe insulation shall be butted up to the coupling, on both sides of the coupling.

.2 The coupling itself shall be covered with TIAC Code A-6 flexible unicellular insulation, molded to the profile of the coupling, with insulation ends butted to the rigid pipe insulation.

.3 Tape joints between fiberglass and unicellular insulation using 3M Polyethylene Tape to maintain continuity of vapor barrier between insulation types.

.4 Cover with preformed PVC jacket fittings suitable for grooved joint couplings.

.9 Finishes:

.1 Exposed indoors: PVC jacket.
.2 Exposed in mechanical rooms: PVC jacket.
.3 Concealed, indoors: all service jacket on piping, valves, fittings. No further finish.
.4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
.5 Outdoors: water-proof aluminum jacket.
.6 Finish attachments: SS bands, at 150 mm on centre. Seals: closed.
.7 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.7 CLEANING

.1 Proceed in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Materials, components, equipment and chemicals for installation of complete HVAC water treatment systems.

.2 Procedures and cleaning solutions for cleaning mechanical piping systems and equipment.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME Boiler and Pressure Vessel Code, Section VII.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM E 202, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 21 05 01 General Provisions – Mechanical. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Sections 21 05 01 General Provisions – Mechanical.

.2 Quality assurance submittals: submit following in accordance with Section 21 05 01 General Provisions – Mechanical.

.1 Instructions: submit manufacturer's installation instructions.

.3 Shop Drawings:

.1 Submit shop drawings in accordance with Section 21 05 01 General Provisions – Mechanical.

.4 Closeout Submittals:

.1 Submit operation and maintenance data for incorporation into manual specified in Closeout Submittals.

.2 Include following:

.1 Log sheets as recommended by manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 21 05 01 General Provisions – Mechanical.

Part 2 PRODUCTS

2.1 MANUFACTURER

.1 Equipment, chemicals, service provided by one supplier.

.1 Approved Manufacturer: Specified Technical Sales or Approved Equal in accordance with frontend clause B6.

2.2 CLEANING SOLUTIONS

.1 Tri-sodium phosphate: 0.40 kg per 100 L water in system.

.2 Sodium carbonate: 0.40 kg per 100 L water in system.

.3 Low-foaming detergent: 0.01 kg per 100 L water in system.

2.3 PROPYLENE GLYCOL/WATER (35% MIXTURE)

.1 Provide factory pre-mixed propylene glycol/water (35% mixture) using deionized water.

.2 Acceptable Products: Model: Dowfrost 65/35 Inhibited Propylene Glycol-Based Heat Transfer Fluid.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install HVAC water treatment systems in accordance with ASME Boiler Code Section VII, and requirements and standards of authorities having jurisdiction, except where specified otherwise.

.2 Ensure adequate clearances to permit performance of servicing and maintenance of equipment.

3.3 CLEANING HYDRONIC AND STEAM SYSTEMS

.1 **Existing hydronic systems to be cleaned and flushed before reconnection to new piping system. Contractor to ensure all terminal heating equipment is isolated such that debris will not pass through.**

.2 Timing: systems operational, hydrostatically tested and with safety devices functional, before cleaning is carried out.

.3 Cleaning Agency:

.1 Retain qualified water treatment specialist to perform system cleaning.

.4 Install instrumentation such as flow meters, orifice plates, pitot tubes, flow metering valves only after cleaning is certified as complete by water treatment specialist.

.5 Cleaning procedures:

.1 Provide detailed report outlining proposed cleaning procedures at least 4 weeks prior to proposed starting date. Report to include:

.1 Cleaning procedures, flow rates, elapsed time.

.2 Chemicals and concentrations used.

.3 Inhibitors and concentrations.

.4 Specific requirements for completion of work.

.5 Special precautions for protecting piping system materials and components.

.6 Complete analysis of water used to ensure water will not damage systems or equipment.

.6 Conditions at time of cleaning of systems:

.1 Systems: free from construction debris, dirt and other foreign material.
.2 Control valves: operational, fully open to ensure that terminal units can be cleaned properly.
.3 Strainers: clean prior to initial fill.
.4 Install temporary filters on pumps not equipped with permanent filters.

.5 Install pressure gauges on strainers to detect plugging.

.7 Report on Completion of Cleaning:

.1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.

.8 Hydronic Systems:

.1 Fill system with water, ensure air is vented from system.
.2 Fill expansion tanks 1/3 to 1/2 full, charge system with compressed air to at least 35 kPa (does not apply to diaphragm type expansion tanks).
.3 Use water metre to record volume of water in system to +/- 0.5%.
.4 Add chemicals under direct supervision of chemical treatment supplier.
.5 Closed loop systems: circulate system cleaner at 60 degrees C for at least 36 h. Drain as quickly as possible. Refill with water and inhibitors. Test concentrations and adjust to recommended levels.
.6 Flush velocity in system mains and branches to ensure removal of debris. System pumps may be used for circulating cleaning solution provided that velocities are adequate.
.7 Add chemical solution to system.
.8 Establish circulation, raise temperature slowly to maximum design 82 degrees C minimum. Circulate for 12 h, ensuring flow in all circuits. Remove heat, continue to circulate until temperature is below 38 degrees C. Drain as quickly as possible. Refill with clean water. Circulate for 6 h at design temperature. Drain and repeat procedures specified above. Flush through low point drains in system. Refill with clean water adding to sodium sulphite (test for residual sulphite).

.9 Glycol Systems:

.1 In addition to general requirements as specified above, perform following:

.1 Test to prove concentration will prevent freezing to -40°F (-40°C). Test inhibitor strength and include in procedural report. Refer to ASTM E 202.

3.4 START-UP OF HYDRONIC SYSTEMS

.1 After cleaning is completed and system is filled:

.1 Establish circulation and expansion tank level, set pressure controls.
.2 Ensure air is removed.
.3 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.
.4 Dismantle system pumps used for cleaning, inspect, replace worn parts, install new gaskets and new set of seals.
.5 Clean out strainers repeatedly until system is clean.

.6 Check pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and other noises.

.7 Bring system up to design temperature and pressure slowly over a 48 hour period.

.8 Adjust pipe supports, hangers, springs as necessary.

.9 Monitor pipe movement, performance of expansion joints, loops, guides, anchors.

.10 If sliding type expansion joints bind or if bellows type expansion joints flex incorrectly, shut down system, re-align, repeat start-up procedures.

.11 Re-tighten bolts using torque wrench, to compensate for heat-caused relaxation. Repeat several times during commissioning.

.12 Check operation of drain valves.

.13 Adjust valve stem packings as systems settle down.

.14 Fully open balancing valves (except those that are factory-set).

.15 Check operation of over-temperature protection devices on circulating pumps.

.16 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.

3.5 CLEANING

.1 Proceed in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Materials, installation and commissioning procedures for electric heating, ventilation and cooling control system(s).

1.2 GENERAL INTENT AND RELATED INFORMATION

.1 All work of the work shall be coordinated and provided by the single BMS Contractor.

.2 The work shall be scheduled, coordinated, and interfaced with the associated work of other trades. Reference the applicable sections for details.

.3 The work shall be as required by the Specifications, Point Schedules and Drawings.

.4 If the BMS Contractor believes there are conflicts or missing information in the project documents, the Contractor shall promptly request clarification and instruction from the design team.

1.3 DEFINITIONS

.1 Analog: A continuously variable system or value not having discrete levels. Typically exists within a defined range of limiting values.

.2 Binary: A two-state system where an “on” condition is represented by one discrete signal level and an “Off” condition is represented by a second discrete signal level.

.3 BMS: The total integrated system of fully operational and functional elements, including equipment, software, programming, and associated materials, to be provided by this Division BMS Contractor and to be interfaced to the associated work of other related trades.

.4 BMS Contractor: The single Contractor to provide the work of this Division. This Contractor shall be the primary manufacturer, installer, commissioner and ongoing service provider for the BMS work.

.5 Control Sequence: A BMS pre-programmed arrangement of software algorithms, logical computation, target values and limits as required to attain the defined operational control objectives.

.6 Direct Digital Control: The digital algorithms and pre-defined arrangements included in the BMS software to provide direct closed-loop control for the

designated equipment and controlled variables. Inclusive of Proportional, Derivative and Integral control algorithms together with target values, limits, logical functions, arithmetic functions, constant values, timing considerations and the like.

.7 BMS Network: The total digital on-line real-time interconnected configuration of BMS digital processing units, workstations, panels, sub-panels, controllers, devices and associated elements individually known as network nodes. May exist as one or more fully interfaced and integrated sub-networks, LAN, WAN or the like.

.8 Node: A digitally programmable entity existing on the BMS network.

.9 BMS Integration: The complete functional and operational interconnection and interfacing of all BMS work elements and nodes in compliance with all applicable codes, standards and ordinances to provide a single coherent BMS as required by this Division.

.10 Provide: The term “Provide” and its derivatives when used in this Division shall mean to furnish, install in place, connect, calibrate, test, commission, warrant, document and supply the associated required services ready for operation.

.11 PC: Personal Computer from a recognized major manufacturer or a virtual equivalent provided by, or with the consent of The City.

.12 Furnish: The term “Furnish” and its derivatives when used in this Division shall mean supply at the BMS Contractor’s expense to the designated third party trade Contractor for installation. BMS Contractor shall connect furnished items to the BMS, calibrate, test, commission, warrant and document.

.13 Wiring: The term “Wiring” and its derivatives when used in this Division shall mean provide the BMS wiring and terminations.

.14 Install: The term “Install” and its derivatives when used in this Division shall mean receive at the jobsite and mount.

.15 Protocol: The term “protocol” and its derivatives when used in this Division shall mean a defined set of rules and standards governing the on-line exchange of data between BMS network nodes.

.16 Software: The term “software” and its derivatives when used in this Division shall mean all of programmed digital processor software, preprogrammed firmware and project specific digital process programming and database entries and definitions as generally understood in the BMS industry for real-time, on-line, integrated BMS configurations.

.17 The use of words in the singular in these Division documents shall not be considered as limiting when other indications in these documents denote that more than one such item is being referenced.

.18 Headings, paragraph numbers, titles, shading, bolding, underscores, clouds and other symbolic interpretation aids included in the Division documents are for general information only and are to assist in the reading and interpretation of these Documents.

.19 The following abbreviations and acronyms may be used in describing the work of this Division:

AHJ	Authority Having Jurisdiction
AI	Analog Input
AO	Analog Output
AWG	American Wire Gauge
BTL	BACnet® Testing Laboratories
CPU	Central Processing Unit
DDC	Direct Digital Control
DI	Digital Input
DO	Digital Output
EEPROM	Electronically Erasable Programmable Read Only Memory
EMI	Electromagnetic Interference
HD	High Definition
HOA	Hand-Off-Auto
I/O	Input/Output
IT	Information Technology
LAN	Local Area Network
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MCC	Motor Control Center
NC	Normally Closed
NO	Normally Open
OAT	Outdoor Air Temperature
OEM	Original Equipment Manufacturer (Private label)
OWS	Operator Workstation
PC	Personal Computer
ppm	parts per million
RAM	Random Access Memory
RF	Radio Frequency
RFI	Radio Frequency Interference
RH	Relative Humidity
ROM	Read Only Memory
RTD	Resistance Temperature Device
TCP/IP	Transmission Control Protocol/Internet Protocol

UPS	Uninterruptible Power Supply
VAC	Volts, Alternating Current
VAV	Variable Air Volume
VDC	Volts, Direct Current
VPN	Virtual Private Network
VSD	Variable Speed Drive
WAN	Wide Area Network

1.4 BMS SYSTEM DESCRIPTION

.1 SUMMARY

.1 The Contractor shall provide and install all essential hardware and software to interface to the existing City of Winnipeg Extended Application and Data Server (ADX).

.2 The Contractor shall design the Metasys User Interface (MUI), to match the existing system. MUI graphics shall use the City of Winnipeg templates.

.3 The Contractor will not have access to the City of Winnipeg SCT server. All MUI files shall be provided by the BMS Contractor in the correct format for merging into the existing system with support from the City of Winnipeg.

.4 The Contractor shall create or add MUI user views to match existing structure.

.5 There is an existing central monitoring system in place. All Direct Digital Controller (DDC) points are identified as centrally monitored points.

.6 All new controls shall be the Series Network Engine (SNE-XX000) supervisory controller which will utilize BACnet/IP and \ or MS/TP field controllers. The Contractor is required to meet with the City of Winnipeg for additional requests if the SNE-XX000 is not in the projects design or additional requirements are required. See note #2 and 3.

.7 Field Controllers shall communicate through BACnet/IP or MSTP bus to a SNE-XX000 supervisory controller. See note #1, and 2.

.8 No LON protocols are to be accepted.

.9 The Contractor to provide commissioning sheets for all points on field devices.

.10 The Contractor to communicate with equipment provider to ensure proper field point integration as well as controllability of the equipment, if not package controls.

.11 If Other vendor (non-JCI) controls are to be used then a seamless integration must be proven before approval will be given. See note #1 and 4.

Notes:

.1 The term BACnet refers to an industry standard protocol which complies with ASHRAE, and must be listed with the BACnet International / BACnet Testing Laboratories (BI/BTL). Basically, states that all devices using the BACnet technology will be able to communicate to each other. The controls Contractor performing the controller installation should confirm that all

devices specified are able to communicate to the proposed devices. Then supply documentation such that all devices supplied will communicate to each other as required for proper operation of the system (PICS Statement, BI/BTL Listing, and ASHRAE listings).

.2 If the Metasys Series Network Engine (SNE) are to be installed on the project then the version of these devices and their software must be such that the City of Winnipeg does not be required to update/upgrade the existing ADX server in order for all user views, alarms, and point monitoring to occur. The Contractor must co-ordinate with City staff to determine the correct version to be installed.

.3 If the Metasys Series Network Engine (SNE) is existing, the Contractor is required to meet with the City of Winnipeg for additional directions.

.4 All points must be integrated back to the City of Winnipeg ADX server. Important: The only way to bring points into the ADX server is to route them through a Johnson Controls supervisory device.

.2 General

.1 The BMS Contractor shall be the primary manufacturer-owned branch office that is regularly engaged in the engineering, programming, installation and service of total integrated BMS.

.2 The BMS Contractor shall be a recognized national manufacturer, installer and service provider of BMS.

.3 The BMS installer shall be a BMS manufacturer-owned branch office, or an independent controls Contractor who is factory trained and authorized by the BMS manufacturer to sell, service and support the BMS specified herein.

.4 As evidence and assurance of the Contractor's ability to support The City's system with service and parts, the Contractor must have been in the BMS business for at least the last ten (10) years and have successfully completed total projects of at least 10 times the value of this Contract in each of the preceding five years.

.5 The BMS Architecture shall consist of the products of a manufacturer regularly engaged in the production of BMS, and shall be the manufacturer's latest standard of design at the time of bid.

1.5 REFERENCES

.1 National Fire Protection Association (NFPA) Standards

.2 National Electric Code (NEC) and applicable local Electric Code

.3 UL

.1 UL listing and labels

.2 UL 864 10th Edition UUKL Smoke Control (for USA and Canada)

.3 UL 268 Smoke Detector

.4 UL 916 Energy Management.

.4 National Fire Protection Association (NFPA)

.1 NFPA 70 – National Electrical Code
.2 NFPA 90A – Standard For The Installation Of Air Conditioning And Ventilating Systems
.3 NFPA 92A and 92B Smoke Purge/Control Equipment

.5 Factory Mutual (FM)

.6 American National Standards Institute (ANSI)

.1 ASHRAE/ANSI 135, Data Communication Protocol for Building Automation and Control Systems (BACnet).
.2 ANSI/EIA 909.1-A-1999

.7 National Electric Manufacturer's Association (NEMA)

.8 American Society of Mechanical Engineers (ASME)

.9 American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

.10 Air Movement and Control Association (AMCA)

.11 Institute of Electrical and Electronic Engineers (IEEE)

.12 American Standard Code for Information Interchange (ASCII)

.13 Electronics Industries Association (EIA)

.14 Occupational Safety and Health Administration (OSHA)

.15 American Society for Testing and Materials (ASTM)

.16 Federal Communications Commission (FCC) including Part 15, RF Devices

.17 Americans Disability Act (ADA)

.18 Canadian Standards Association (CSA)

.1 CSA C22.1 Canadian Electrical Code.

.19 National Research Council of Canada (NRC)

.1 National Building Code of Canada.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

.1 Shop Drawings, Product Data, and Samples

.1 The BMS Contractor shall submit a list of all shop drawings with submittals dates within 30 days of Contract award.

.2 Submittals shall be in defined packages. Each package shall be complete, shall only reference itself, and previously submitted packages. The packages shall be as approved by the Contract Administrator and Contract Administrator for Contract compliance.

.3 Allow 15 working days for the review of each package by the Contract Administrator and Contract Administrator in the scheduling of the total BMS work.

.4 Equipment and systems requiring approval of local authorities must comply with such regulations and be approved. Filing shall be at the expense of the BMS Contractor where filing is necessary. Provide a copy of all related correspondence and permits to The City.

.5 Prepare an index of all submittals and shop drawings for the installation. Index shall include a shop drawing identification number, Contract Documents reference and item description.

.6 The BMS Contractor shall correct any errors or omissions noted in the first review.

.7 At a minimum, submit the following:

.1 BMS network Architecture diagrams including all nodes and interconnections

.2 Systems schematics, sequences, and flow diagrams

.3 Points schedule for each point in the BMS, including: Point Type, Object Name, Expanded ID, Display Units, Controller type, and Address

.4 Samples of Graphic Display screen types and associated menus

.5 Detailed Bill of Material list for each system or application, identifying quantities, part numbers, descriptions, and optional features

.6 Control Damper Schedule including a separate line for each damper provided under this section and a column for each of the damper attributes, including Code Number, Fail Position, Damper Type, Damper Operator, Duct Size, Damper Size, Mounting, and Actuator Type

.7 Room Schedule including a separate line for each VAV box and/or terminal unit indicating location and address

.8 Control Valve Schedules including a separate line for each valve provided under this section and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close off Pressure, Capacity, Valve CV, Design Pressure, and Actuator Type

.9 Details of all BMS interfaces and connections to the work of other trades.

.10 Product data sheets or marked catalog pages including part number, photo and description for all products including software

.2 Existing Systems Inventory

.1 Where applicable, provide a complete and current BMS site inventory for all existing field and supervisory controllers to be integrated into the new BMS including manufacturer, model number, firmware version, available updates, battery condition, integrations, controlled equipment, and point counts.

.2 Site inventory shall be provided on a separate, new USB compatible flash drive.

.3 Control Diagrams:

.1 Use at least one individual sheet for each major system.

.2 System flow diagram with sensing, control and interlock devices shown.

.3 Internal control panel layouts, control panel cover layouts, electrical connections inside control panels.

.4 Ladder type wiring diagrams showing interlock, monitoring and control wiring to and from mechanical and electrical equipment.

.5 Communications wiring schematic drawings indicating interconnections between application specific controllers, custom application controllers, application generic controllers, OWS's and other system peripherals.

.6 Flow chart control sequences.

.4 Descriptive data and sequence of operations for operating users and application software including operator's manual and programmer's manual.

.5 Point to point and basic function commissioning forms to be used on site for the start, test and check of controls components and systems.

.6 Functional performance test documentation and procedures to be used in commissioning control sequences.

.1 Functional performance test documentation for each system or equipment referenced in Part 3.4 and/or scope of work to include the following:

.1 System or Equipment Identifier or Tag,

.2 List of setpoints,

.3 Verification of inputs and outputs,

.4 Verification of each sequence of operation mode,

.5 Verification of alarms,

.6 Deficiencies found during verification,

.7 Date of testing,

.8 Personnel performing test.

.7 List of component sizes, mounting orientations, capacities and locations for; Valves, damper actuators, pressure taps and temperature well schedules.

.8 Provide installation details and specific instructions for equipment.

.9 Submit drawings indicating specific locations of electrical power to control panels.

.10 Quality assurance submittals: submit following in accordance with Section 01 00 00.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
.2 Instructions: submit manufacturer's installation instructions.
.3 Contract Administrator will make available 1 copy of systems supplier's installation instructions.

.11 Maintenance Data and Service:

.1 Provide maintenance data for incorporation into maintenance manuals as specified in section 23 05 00 - Common Work Results for HVAC.
.2 Provide as-built information in accordance with Section 21 05 01 and Section 01 00 00.

.12 Guarantee

.1 Provide a written guarantee stating the controls and instrumentation are guaranteed against faulty material and workmanship for a period of one year from the date of the Certification of Substantial Completion.

.13 Operating Instructions

.1 Provide operating instructions for the heat recovery control system in accordance with the General Conditions of the Contract and include a description of the sequence of operation and "as-built" drawings of the system schematics.

.14 Special servicing conditions and expanded warranty or service Contract proposals.

.15 List of recommended spare parts and calibration tools for The City's Maintenance Staff.

1.7 RECORD DOCUMENTATION

.1 Operation and Maintenance Manuals.

.1 Three (3) copies of the Operation and Maintenance Manuals shall be provided to The City's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact

Disc media or USB Flash Drive, and include the following for the BMS provided:

.1 Table of contents

.2 As-built system record drawings. Computer Aided Drawings (CAD) record drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal

.3 Manufacturer's product data sheets or catalog pages for all products including software

.4 System Operator's manuals

.5 Archive copy of all site-specific databases and sequences

.6 BMS network diagrams

.7 Interfaces to all third party products and work by other trades

.2 The Operation and Maintenance Manual shall be self-contained, and include all necessary software required to access the product data sheets. Include a logically organized table of contents. Viewer software shall provide the ability to display, zoom, print, and search all documents.

1.8 SCOPE OF WORK

.1 General:

.1 Coordinate with electrical, provide and install dedicated 120V circuit as required for control works; wiring methods to Division 26 standards.

.2 Responsibility for all control wiring and low-voltage panels, mounting and operational commissioning of control related devices and of loose supplied controls provided by others as part of a packaged equipment supply.

.3 Wiring required under this section to be performed by this section except as noted otherwise. Refer to Division 26 for wiring methods and EMT conduit systems required by all wiring performed under this section.

.4 Provide O&M training as noted in 21 05 01 General Provisions – Mechanical.

.2 Design and installation of low voltage, automatic controls for the following systems and equipment:

.1 Hot Water Boilers, B-01 & B-02,

.2 Hot Water Plant Control Panel,

.3 Hot Water Boiler Pumps, BP-01, BP-02, Hot Water Circulating Pumps, CP-01, CP-02 and Glycol Pumps GP-01 to GP-02, Chilled Water Circulating Pumps, CWP-01, CWP-02,

.4 Glycol Fill Stations,

.5 Supply and Return Water Temperature Sensors,

.6 Low temperature alarm to integrate into the building's security alarm,

.7 Two and three way control valves,

.8 Energy Recovery Ventilator, ERV-01,

.9 Air Handling Unit, AHU-01,
.10 Fan Coils, FC,
.11 Force Flow Heaters, FF,
.12 Unit Heaters, UH,
.13 New Commercial fans,
.14 Baseboard Heaters, BB,
.15 Air Cooled Chiller, CH-01,
.16 Condensing Unit, CU-01,
.17 Stand alone gas monitoring system and alarm.

.3 Coordination and commissioning of boiler plant controller and packaged boiler controls, including but not limited to:

.1 Outside air temperature sensor, OATS-1,
.2 Outdoor air reset controller,
.3 Low water cut-offs,

.4 Coordination and commissioning of packaged pump controls, including but not limited to:

.1 Wire pump pairs together to facilitate parallel pumping.

.5 Commissioning of all new and existing (where applicable) control systems including but not limited to the display of graphics, correct implementation of control sequences, proper response from physical devices, alarms, schedules, seasonal switch-overs, etc. Contractor will be required to demonstrate on site to the Contract Administrator that the system has been commissioned and is operating correctly under all operating sequences.

1.9 QUALIFICATIONS AND SUPPORT

.1 Controls Manufacturer Minimum Qualifications; demonstrate to The City/Contract Administrator not less than 5 years experience in the production of specified products or functionality equivalent products.

.2 The Control Contractor shall provide qualified manpower for a complete control system design, installation and testing and commissioning. Sufficient staff shall be dedicated to the project to ensure its timely execution in accordance with the overall project design and construction schedules.

.3 The Controls Contractor shall be capable of supporting all peripheral functions, including start-up, testing, commissioning and The City staff training, as well as providing on-site warranty and maintenance services.

1.10 CODES & STANDARDS

.1 Work, materials, and equipment shall comply with the most restrictive of local, provincial, and federal authorities' codes and ordinances or these plans and

specifications. As a minimum, the installation shall comply with current editions in effect 30 days prior to receipt of bids.

1.11 WARRANTY

.1 Standard Material and Labor Warranty:

.1 Provide a one-year labor and material warranty on the BMS.

.2 If within twelve (12) months from the date of acceptance of product, upon written notice from The City, it is found to be defective in operation, workmanship or materials, it shall be replaced, repaired or adjusted at the option of the BMS Contractor at the cost of the BMS Contractor.

.3 Maintain an adequate supply of materials within 100 miles of the Project site such that replacement of key parts and labor support, including programming. Warranty work shall be done during BMS Contractor's normal business hours.

Part 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

.1 Metasys by Johnson Controls Inc.

2.2 MANUFACTURED ITEMS

.1 Catalogued or published ratings shall be those items obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards in force.

2.3 DDC BUILDING AUTOMATION SYSTEM

.1 System Performance

.1 Reporting Accuracy. System shall report values with minimum end-to-end accuracy listed in Table 1.

Table 1: Reporting Accuracy

Measured Variable	Reported Accuracy
Space Temperature	±0.5°C (±1°F)
Ducted Air	±0.5°C (± 1 °F)
Outside Air	± 1.0°c (±2°F)
Dew Point	± 1.5°C (±3°F)

Water Temperature	±0.5°C (± 1 °F)
Delta-T	±0.15°C (±0.25°F)
Relative Humidity	±2% RH
Water Flow	±2% of full scale
Airflow (terminal)	± 10% of full scale (See note 1)
Airflow (measuring stations)	±5% of full scale
Airflow (pressurized spaces)	±3% of full scale
Air Pressure (ducts)	±25 Pa (±0.1 in. w.g.)
Air Pressure (space)	±3 Pa (±0.01 in. w.g.)
Water Pressure	±2% of full scale (see Note 2)
Electrical (A, V, W, Power Factor)	± 1 % of reading (see Note 3)
Carbon Monoxide (CO)	±5% of reading
Carbon Dioxide (CO2)	±25 ppm

Note 1: 10% - 100% of scale

Note 2: For both absolute and differential pressure

Note 3: Not including utility-supplied meters

.4 Communication

.1 Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ASHRAE/ANSI Standard 135-2004, BACnet.

.2 Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.

.3 Internetwork operator interface and value passing shall be transparent to internetwork Architecture.

.4 Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute control strategies specified in Section 23 09 33. An authorized operator shall

be able to edit cross-controller links by typing a standard object address or by using a point- and-click interface.

.5 Controllers with real-time clocks shall use the BACnet Time Synchronization service. System shall automatically synchronize system clocks daily from an operator-designated controller via the internetwork. When applicable, system shall automatically adjust for daylight saving and standard time.

.6 System shall be expandable to at least three times the required input and output objects with additional controllers, associated devices, and wiring.

.6 Web Browser Operating Interface

.1 The operator interface shall also be fully available through a web browser. From a browser such as Microsoft's Internet Explorer, an operator shall be able to perform all functions on the same standard and custom graphics as used in the standard operator interface. All custom graphics, alarm graphics and standard graphics shall be available without modification or reengineering through a browser user interface and shall be fully functional.

.2 The browser interface shall provide login and security authentication in the same way as the standard operator interface. It shall be possible to operate the facility through the browser user interface in the same way as the standard user interface and perform all functions described in this revision of the controls specification, for example: acknowledge alarms, view graphics, control points, execute reports, and modify configuration settings and the like.

.3 The Web Browser software may be hosted in the Building Controller (BC) or in a dedicated Web Server. The hardware and software shall be provided to accommodate a minimum of three times the required data and graphic file without any additions or modifications to the server.

.7 System Software

1. System Graphics. Operator interface shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each hot water system, and graphics that summarize conditions on each floor of each building included in this Contract. Indicate thermal comfort on floor plan summary graphics using dynamic colors to represent zone temperature relative to zone setpoint. Provide subordinate graphics to each mechanical system graphic.

    1. Functionality. Graphics shall allow operator to monitor system status, to view a summary of the most important data for each controlled zone or piece of equipment, to use point-and-click

navigation between zones or equipment, and to edit setpoints and other specified parameters.

2. Animation. Graphics shall be able to animate by displaying different image files for changed object status.

3. Alarm Indication. Indicate areas or equipment in an alarm condition using color or other visual indicator.

4. Format. Graphics shall be saved in an industry-standard format such as BMP, JPEG, or GIF.

2. System Tools. System shall provide the following functionality to authorized operators as an integral part of the operator interface or as stand-alone software programs. If furnished as part of the interface, the tool shall be available from each workstation or web browser interface. If furnished as a stand-alone program, software shall be installable on standard IBM-compatible PCs with no limit on the number of copies that can be installed under the system license

1. Automatic System Database Configuration. Each workstation or web server shall store on its hard disk a copy of the current system database, including controller firmware and software. Stored database shall be automatically updated with each system configuration or controller firmware or software change.

2. Controller Memory Download. Operators shall be able to download memory from the system database to each controller.

3. System Configuration. Operators shall be able to configure the system.

4. Online Help. Context-sensitive online help for each tool shall assist operators in operating and editing the system.

5. Security. System shall require a user name and password to view, edit, add, or delete data.

1. Operator Access. Each user name and password combination shall define accessible viewing, editing, adding, and deleting functions in each system application, editor, and object.

2. Automatic Log Out. Automatically log out each operator if no keyboard or mouse activity is detected. Operators shall be able to adjust automatic log out delay.

3. Encrypted Security Data. Store system security data including operator passwords in an encrypted format. System shall not display operator passwords

6. System Diagnostics. System shall automatically monitor controller and 1/0 point operation. System shall annunciate controller failure and 1/0 point locking (manual overriding to a fixed value).

7. Alarm Processing. System input and status objects shall be configurable to alarm on departing from and on returning to normal state. Operator shall be able to enable or disable each alarm and to configure alarm limits, alarm limit differentials, alarm states, and alarm reactions for each system object. Configure and enable alarm points as specified in Section 23 09 33. As a minimum provide high and low alarm setpoints for fill analog inputs. For reset loops provide floating setpoint deviation alarms. Alarms shall be BACnet alarm objects and shall use BACnet alarm services.

8. Alarm Messages. Alarm messages shall use an English language descriptor without acronyms or mnemonics to describe alarm source, location, and nature.

9. Alarm Reactions. Operator shall be able to configure (by object) actions workstation or web server shall initiate on receipt of each alarm. As a minimum, workstation or web server shall be able to log, print, start programs, display messages, send e-mail, send page, and audibly annunciate.

10. Alarm Maintenance. Operators shall be able to view system alarms and changes of state chronologically, to acknowledge and delete alarms, and to archive closed alarms to the workstation or web server hard disk from each workstation or web browser interface.

11. Trend Configuration. Operator shall be able to configure trend sample or change of value (COV) interval, start time, and stop time for each system data object and shall be able to retrieve data for use in spreadsheets and standard database programs. Controller shall sample and store trend data and shall be able to archive data to the hard disk.). The Contractor shall set up trending for all inputs and outputs to facilitate system verification and fine-tuning. System must have sufficient memory and storage to continuously trend all data points (including 150 future

hardware data points) at a minimum interval of 30 minutes for 6 months. Trends shall be BACnet trend objects.

12. Object and Property Status and Control. Operator shall be able to view, and to edit if applicable, the status of each system object and property by menu, on graphics, or through custom programs.

13. Reports and Logs. Operator shall be able to select, to modify, to create, and to print reports and logs. Operator shall be able to store report data in a format accessible by standard spreadsheet and word processing programs.

14. Standard Reports. Furnish the following standard system reports:

    1. Objects. System objects and current values filtered by object type, by status (in alarm, locked, normal), by equipment, by geographic location, or by combination of filter criteria.

    2. Alarm Summary. Current alarms and closed alarms. System shall retain closed alarms for an adjustable period.

    3. Logs. System shall log the following to a database or text file and shall retain data for an adjustable period (Minimum 1 year):

        1. Alarm History.

        2. Trend Data. Operator shall be able to select trends to be logged.

        3. Operator Activity. At a minimum, system shall log operator log in and log out, control parameter changes, schedule changes, and alarm acknowledgment and deletion. System shall date and time stamp logged activity.

15. Custom Reports: Operator shall be able to create custom reports that retrieve data, including archived trend data, from the system, that analyze data using common algebraic calculations, and that present results in tabular or graphical format. Reports shall be launched from the operator interface.

16. Graphics Generation. Graphically based tools and documentation shall allow Operator to edit system graphics, to create graphics, and to integrate graphics into the system. Operator shall be able

to add analog and binary values, dynamic text, static text, and animation files to a background graphic using a mouse.

17. Graphics Library. Complete library of standard HVAC equipment graphics shall include equipment such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. Library shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. Library graphic file format shall be compatible with graphics generation tools.

18. Custom Application Programming. Operator shall be able to create, edit, debug, and download custom programs. System shall be fully operable while custom programs are edited, compiled, and downloaded. Programming language shall have the following features:

    1. Language. Language shall be graphically based or English language oriented. If graphically based, language shall use function blocks arranged in a logic diagram that clearly shows control logic flow. Function blocks shall directly provide functions listed below, and operators shall be able to create custom or compound function blocks. If English language oriented, language shall be based on the syntax of BASIC, FORTRAN, C, or PASCAL, and shall allow for free-form programming that is not column• oriented or "fill-in-the-blanks."

    2. Programming Environment. Tool shall provide a full-screen, cursor-and-mouse-driven programming environment or character editor that incorporates word processing features such as cut and paste. Operators shall be able to insert, add, modify, and delete custom programming code, and to copy blocks of code to a file library for reuse in other control programs.

    3. Independent Program Modules. Operator shall be able to develop independently executing program modules that can disable, enable and exchange data with other program modules.

    4. Debugging and Simulation. Operator shall be able to step through the program observing intermediate values and results. Operator shall be able to adjust input variables to simulate actual operating conditions.

Operator shall be able to adjust each step's time increment to observe operation of delays, integrators, and other time-sensitive control logic. Debugger shall provide error messages for syntax and for execution errors.

5. Conditional Statements. Operator shall be able to program conditional statements (IFWHEN/ELSE/ELSE-IF)using compound Boolean (AND, OR, and NOT) and relational (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.

6. Mathematical Functions. Language shall support floating-point addition, subtraction, multiplication, division, and square root operations, as well as absolute value calculation and programmatic selection of minimum and maximum values from a list of values.

7. Variables: Operator shall be able to use variable values in program conditional statements and mathematical functions.

8. Time Variables. Operator shall be able to use predefined variables to represent time of day, day of the week, month of the year, and date. Other predefined variables or simple control logic shall provide elapsed time in seconds, minutes, hours, and days. Operator shall be able to start, stop, and reset elapsed time variables using the program language.

9. System Variables. Operator shall be able to use predefined variables to represent status and results of Controller Software and shall be able to enable, disable, and change setpoints of Controller Software as described in Controller Software section.

.8 Power Supplies and Line Filtering

.1 Power Supplies. Control transformers shall be CSA listed. Furnish Class 2 current• limiting type or furnish over-current protection in primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.

.1 Dielectric strength of 1000 V minimum

.2 Response time of 10 nanoseconds or less

.3 Transverse mode noise attenuation of 65 dB or greater

.2 Common mode noise attenuation of 150 dB or greater at 40-100 Hz

2.4 GENERAL

.1 Control Network

.1 Network Engines shall provide supervisory control over the control network and shall selectively support the following communication protocols:

.1 BACnet Standard Master-Slave/Token-Passing (MS/TP) Bus Protocol ASHRAE SSPC-135:

.1 The Network Engines shall be BTL listed/certified.

.2 The Network Engines shall be tested and certified as a BACnet Building Controller (B-BC) profile.

.2 Control networks shall provide either "Peer-to-Peer", Master-Slave, or Supervised Token Passing communications, and shall operate at a minimum communication speed of 38400 baud.

.3 Control network shall support digital controllers as indicated in plans and specifications.

.4 Default control network communication protocol for this project shall be BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135.

.5 A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided for each controller device (master or slave) that will communicate on the BACnet MS/TP Bus.

.6 The PICS shall be submitted 10 days prior to bidding.

.2 Integration

.1 Hardwired

.1 Analog and digital signal values shall be passed from one system to another via hardwired connections.

.2 There will be one separate physical point on each system for each point to be integrated between the systems.

.2 Direct Protocol (Integrator Panel)

.1 The BMS system shall include appropriate hardware equipment and software to allow bi-directional data communications between the BMS system and third party manufacturers' control panels. The BMS shall have the ability to receive, react to, and return information from multiple building systems, including but not limited to the chillers, boilers, variable frequency drives, power monitoring system, and medical gas.

.2 All data required by the application shall be mapped into the Automation Engine's database, and shall be transparent to the operator.

.3 Point inputs and outputs from the third party controllers shall have real-time interoperability with BMS software features such as:

Control Software, Energy Management, Custom Process Programming, Alarm Management, Historical Data and Trend Analysis, Totalization, and LAN Communications.

.3 BACnet Protocol Integration – BACnet

.1 The neutral protocol used between systems will be BACnet IP and comply with the ASHRAE BACnet standard 135.

.2 A complete Protocol Implementation Conformance Statement (PICS) shall be provided for all BACnet system devices.

.3 The ability to command, share point object data, change of state (COS) data and schedules between the host and BACnet systems shall be provided.

2.5 NETWORK ENGINES

.1 General

.1 The Network Engine shall be a fully user-programmable, supervisory controller. The Network Engine(s) shall monitor the network of distributed equipment controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Engine(s).

.2 Automation network – The Network Engine(s) shall reside on the automation network and shall support a subnet of system controllers.

.3 User Interface – Each Network Engine shall have the ability to deliver a web-based User Interface using the Site Management Portal functionality previously described. All computers connected physically or virtually to the automation network shall have access to the web-based user interface.

.1 The web-based user interface software shall be embedded in the Network Engine(s). Systems that require a local copy of the system database on the user's device are not acceptable.

.2 The Network Engine(s) shall support a minimum of two (2) concurrent users.

.3 The web-based user interface shall have the capability to access all system data through a single Network Engine.

.4 Remote users connected to the network using a Virtual Private Network (VPN) shall also have total system access through one Network Engine.

.5 Systems that require the user to address more than one Network Engine to access all system information are not acceptable.

.6 The Network Engine shall have the capability of serving web-based user interface graphics. The graphics capability shall be embedded in the Network Engine.

.7 Systems that only support user interface graphics from a central database or require the graphics to reside on the user's device are not acceptable.

.8 The web-based user interface shall support the following functions using a supported web browser:

.1 Configuration

.2 Commissioning

.3 Data Archiving

.4 Monitoring

.5 Commanding

.6 System Diagnostics

.9 Systems that require workstation software or modified web browsers for system queries are not acceptable.

.4 Processor – The Network Engine(s) shall be microprocessor-based with a minimum word size of 32 bits. The Network Engine(s) shall be a multi-tasking, multi-user, and real-time digital control processor. Standard operating systems shall be employed. Network Engine(s) size and capability shall be sufficient to fully meet the requirements of this Specification.

.5 Memory – Each Network Engine shall have sufficient memory to support its own operating system, databases, and control programs, and to provide supervisory control for all control level devices.

.6 Secure Boot – The Network Engine(s) shall prevent malicious or unauthorized software applications from loading during the system startup process.

.7 User Authentication – The Network Engine(s) shall support local and Remote Authentication Dial-in User Service (RADIUS) authentication.

.8 Password Security – Access to the Network Engines' embedded user interface shall require a password of 8 to 50 characters including a minimum of one lower case letter, one upper case letter, one number, and one special character. An alarm shall be generated after three unsuccessful attempts within 15 minutes, and the user shall be denied access until permission is renewed by a system administrator.

.9 Network Security – Communication between the Network Engine and other system networked devices including additional Network Engines, Application and Data Servers, Open Data Servers (BACnet listed OWS), and user interface clients shall be encrypted and support HTTPS with Transport Level Security (TLS) Version 1.2. Self-signed certificates are to be provided with the option of configuring trusted certificates.

.10 Hardware Real Time Clock – The Network Engine(s) shall include an integrated, hardware-based, real-time clock, with a supercapacitor to maintain time for a minimum of 72 hours during a power loss. Controllers using a battery to maintain time during a power loss shall not be acceptable.

.11 Diagnostics – The Network Engine(s) shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The Network Engine(s) shall provide both local and remote

annunciation of any detected component failures or repeated failures to establish communication.

.12 Power Failure – In the event of the loss of normal power, the Network Engine(s) shall continue to operate for a user adjustable period of up to 10 minutes after which there shall be an orderly shutdown of all programs to prevent the loss of database or operating system software.

.1 During a loss of normal power, the control sequences shall go to the normal system shutdown conditions. All critical configuration data shall be saved into Flash memory.

.2 Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.

.13 Certification – The Network Engine(s) shall meet and be listed to the UL 916 Standard for Energy Management Equipment and be FCC Compliant to CFR47, Part 15, Subpart B, Class A.

.14 Device Integration – The Network Engine(s) shall support integrating networked devices using the following communication protocols on the device/controller network:

.1 The Network Engine(s) shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135 on the controller network.

.1 The Network Engine(s) shall support Remote Field Bus integration via a BACnet IP to MS/TP router.

.2 The Network Engine(s) shall be tested and BTL listed/certified as a BACnet Building Controller (B-BC).

.3 A BACnet Protocol Implementation Conformance Statement shall be provided for the Network Engine(s).

.4 The Protocol Implementation Conformance Statement shall be submitted 10 days prior to bidding.

.2 The Network Engine(s) shall support Johnson Controls N2 or third party N2 Open devices

.3 The Network Engine(s) shall optionally support integration of networked devices using the following networking protocols:

.1 MODBUS RTU

.2 MODBUS TCP

.3 KNX - KNX is an open communication standard (EN 50090, ISO/IEC 14543) that many European manufacturers have applied to lighting controls, blinds and shutters, HVAC controls, security systems, energy management, audio, video, displays, and remote controls.

.4 M-Bus - M-Bus (Meter Bus) is a European standard (EN 1434-3) that applies primarily to energy and heat meters.

.5 C-CURE 9000 Access Control System

.6 victor Video Management System

.15 The Network Engine(s) shall include the following multi-color, flashing LEDs to indicate important operating conditions and status:

.1 Heartbeat – to indicate each of the following states: operational (normal), powered but not operational, starting up, shutting down, or no power applied

.2 Fault – to indicate if fault conditions have been detected

.3 Ethernet Activity – to indicate if Ethernet Traffic is occurring or not occurring.

.4 Ethernet Link Speed – to indicate the speed of Ethernet Link (10, 100, or 1000 Mbps)

.5 Site Director – to indicate if the Network Engine has been designated as the Site Director

.6 BACnet/IP – to indicate if the Network Engine is transmitting BACnet messages over BACnet/IP to other devices, including other Network Engines

.7 USB -1 – to indicate if a supported device is connected, no device is connected, or an unsupported device is connected on USB port 1

.8 USB-1 – to indicate if a supported device is connected, no device is connected, or an unsupported device is connected on USB port 2

.9 FC BUS-# – to indicate if communication is occurring on FC Bus port # (1 or 2)

.10 FC EOL-# – to indicate if the end-of-line termination switch # (1 or 2) is on or off

.2 Standard

.1 The Network Engine shall support up to 50 supervised devices across all supported integrations.

.2 Communications Ports – The Network Engine(s) shall provide the following ports for connecting networkable devices:

.1 Two (2) USB ports

.2 One (1) RS-485 ports

.3 One (1) Ethernet port

.3 Provide Johnson Controls Series Network Engine (SNE-XX000) or Approved Equal in accordance with frontend clause B6 as indicated on plans.

2.6 DDC EQUIPMENT CONTROLLERS

.1 General Purpose Equipment Controller

.1 The General Purpose Equipment Controller (CGM) shall be a fully programmable, digital controller that communicates via BACnet MS/TP protocol.

.1 The CGM shall support BACnet Standard ANSI/ASHRAE 135.

.1 The CGM shall be BTL listed/certified.

.2 The CGM shall be tested and certified as a BACnet Advanced Application Controller (B-AAC).

.3 A BACnet Protocol Implementation Conformance Statement shall be provided for the CGM.

.4 The Conformance Statement shall be submitted 10 days prior to bidding.

.2 The CGM shall employ finite state programming to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.

.3 CGM controllers shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only shall not be acceptable.

.4 The CGM shall be assembled in a plastic housing with protection class IP20 (IEC529) and flammability rated to UL94-5VB.

.5 The CGM shall include an integral real-time clock and support time-based tasks which enables these field controllers to monitor and control:

.1 Schedules

.2 Calendars

.3 Alarms

.4 Trends

.6 The CGM can continue time-based monitoring when offline for extended periods of time from a network.

.7 The CGM can operate as a stand-alone controller in applications that do not require a networked supervisory device or for network applications where it is preferred to have the scheduling, alarming, and/or trending performed locally in the equipment controllers.

.8 The CGM shall include troubleshooting LEDs to indicate the following conditions:

.1 Power—to indicate if the controller is powered or not powered.

.2 Fault – to indicate if the controller is in its default state, has no faults, has a device fault, is in startup or download mode, or has an SA Bus communication issue

.3 SA Bus – to indicate if SA Bus communication is occurring and normal, is not occurring, or was occurring but has been lost and is waiting to rejoin

.4 FC Bus – to indicate if FC Bus communication is occurring and normal, is not occurring, or was occurring but has been lost and is waiting to rejoin.

.5 EOL – to indicate if the end-of-line termination switch is on or off

.9 The CGM shall have the ability to transfer and apply firmware files to all SA Bus IOM devices connected to it.

.10 The CGM shall include pluggable and labeled screw terminal blocks for all I/O, FC and SA Bus communication, and power wiring connections.

.11 The CGM shall accommodate the direct wiring of analog and binary I/O field points with the following resolution.

.1 Inputs – 24-bit analog-to-digital converter

.2 Outputs – +/- 200 mV accuracy in 0-10 VDC applications

.12 The CGM shall support the following types of inputs and outputs supplied in the amounts required for the specified applications:

.1 Universal Inputs – shall be configurable to monitor any of the following:

.1 0-10 VDC analog input

.2 4-20 mA analog input

.3 0-600k ohms analog input

.4 Dry contact binary input

.2 Binary Inputs – shall be configurable to monitor either of the following:

.1 Dry Contact Maintained Mode

.2 Pulse Counter Mode

.3 Analog Outputs – shall be configurable to output either of the following:

.1 0-10 VDC analog output

.2 4-20 mA analog output

.4 Binary Outputs – shall output the following:

.1 24 VAC Triac

.5 Configurable Outputs – shall be capable of the following:

.1 0-10 VDC analog output

.2 24 VAC Triac binary output

.13 The CGM shall have the ability to reside on a Field Controller Bus (FC Bus).

.1 The FC Bus shall be a MS/TP Bus supporting BACnet Standard protocol SSPC-135.

.2 The FC Bus shall support communications between the CGMs and the Network Engine.

.3 The FC Bus shall also support Input/Output Module (IOM) communications with the CGM and with the Network Engine.

.4 The FC Bus shall support a minimum of 100 IOMs and CGMs in any combination.

.5 The FC Bus shall operate at a maximum distance of 15,000 Ft. between the CGM and the furthest connected device.

.14 The CGM shall include three (3) decimal rotary dial switches for setting the BACnet MS/TP device address.

.15 The CGM shall have the ability to monitor and control a network of sensors and actuators over a SA Bus.

.1 The SA Bus shall be a MS/TP Bus supporting BACnet Standard Protocol SSPC-135.

.2 The SA Bus shall support a minimum of 10 devices per trunk.

.3 The SA Bus shall operate at a maximum distance of 1,200 Ft. between the CGM and the furthest connected device.

.16 The CGM shall have the capability to execute complex control sequences involving direct wired I/O points as well as input and output devices communicating over a MS/TP Bus.

.17 The CGM shall support, but not be limited to, the following applications.

.1 Cooling central plant applications

.2 Heating central plant applications.

.3 Built-up air handling units for special applications.

.4 Terminal & package units.

.5 Special programs as required for systems control.

.18 The CGM shall support a Local Controller Display as a remote device communicating over the SA Bus.

.1 The Display shall use a BACnet Standard SSPC-135 MS/TP protocol.

.2 The Display shall allow the user to view monitored points without logging into the system.

.3 The Display shall allow the user to view and change setpoints, modes of operation, and parameters.

.4 The Display shall provide password protection with user adjustable password timeout.

.5 The Display shall be menu driven with separate paths for:

.1 Input/Output

.2 Parameter/Setpoint

.3 Overrides

.6 The Display shall use easy-to-read English text messages.

.7 The Display shall allow the user to select the points to be shown and in what order.

.8 The Display shall support a back lit LCD with adjustable contrast and brightens and automatic backlight brightening during user interaction.

.9 The display shall be a minimum of 4 lines and a minimum of 20 characters per line.

.10 The Display shall have a keypad with no more than 6 keys.

.11 The Display shall be panel mountable.

.19 Provide Johnson Controls CGM or Approved Equal in accordance with frontend clause B6 as shown on plans.

2.7 INPUT/OUTPUT MODULE

.1 The Input/Output Module (IOM) provides additional inputs and outputs for use in digital controllers.

.2 The IOM shall communicate with controllers over the FC Bus or the SA Bus.

.3 The IOM shall support BACnet Standard ANSI/ASHRAE 135.

.1 The IOM shall be BTL listed/certified and carry the BTL Label.

.2 The IOM shall be tested and certified as a BACnet Application Specific Controller (B-ASC).

.3 A BACnet Protocol Implementation Conformance Statement shall be provided for the IOM.

.4 The Conformance Statement shall be submitted 10 days prior to bidding.

.4 The IOM shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.

.5 The IOM shall have a minimum of 4 points to a maximum of 17 points.

.6 The IOM shall support the following types of inputs and outputs:

.1 Universal Inputs – shall be configured to monitor any of the following:

.1 Analog Input, Voltage Mode

.2 Analog Input, Current Mode

.3 Analog Input, Resistive Mode

.4 The IOM shall provide minimum 15 bit A/D resolution of analog inputs

.5 Binary Input, Dry Contact Maintained Mode

.6 Binary Input, Pulse Counter Mode

.2 Binary Inputs – shall be configured to monitor either of the following:

.1 Dry Contact Maintained Mode

.2 Pulse Counter Mode

.3 Analog Outputs – shall be configured to output either of the following:

.1 Analog Output, Voltage Mode

.2 Analog Output, current Mode

.3 The IOM shall provide minimum 15 bit D/A resolution of analog outputs

.4 Binary Outputs – shall output the following:

.1 24 VAC Triac

.5 Configurable Outputs – shall be capable of the following:

.1 Analog Output, Voltage Mode

.2 Binary Output Mode

.7 The IOM shall include troubleshooting LEDs to indicate the following conditions:

.1 Power On
.2 Power Off
.3 Download or Startup in progress, not ready for normal operation
.4 No Faults
.5 Device Fault
.6 Normal Data Transmission
.7 No Data Transmission
.8 No Communication

.8 Provide Johnson Controls IOM or Approved Equal in accordance with frontend clause B6 as shown on plans.

2.8 NETWORK THERMOSTAT

.1 General

.1 Thermostat shall be compete with temperature, humidity and CO_2 sensors.
.2 Thermostats provided with lockable, yellowing resistant, clear plastic guard.
.3 Key lock with inner shelf to prevent tampering.
.4 Thermostats installed with Wiremold box, or equal.

.2 The network thermostat shall be capable of controlling two- or four-pipe fan coils, cabinet unit heaters, a pressure dependent VAV System, zoning type systems employing reheat including local hydronic reheat valves, or other similar equipment.

.3 The Networked Thermostat shall communicate over the FC Bus using BACnet Standard protocol SSPC-135 or Johnson Controls N2 protocol.

.1 Communications shall be selectable locally at thermostat through the display.

.4 The TEC shall be BTL listed/certified and carry the BTL Label.

.1 The TEC shall be tested and certified as a BACnet Application Specific Controller (B-ASC).

.2 A BACnet Protocol Implementation Conformance Statement shall be provided for the TEC.

.3 The Conformance Statement shall be submitted 10 days prior to bidding.

.5 The network thermostat shall include a 4.2 inch LED backlit touch screen with the following configurable icons.

.1 Home screen configurable icons include:

.1 On/Off icon

.2 Fan override icon

.3 Zone temperature icon

.4 Hold temperature icon

.5 Zone humidity (on applicable models) icon

.6 Occupancy status (on applicable models) icon

.7 Temperature setpoint icon

.8 Alarm icon

.9 Unit status icon

.10 Date/Time icon

.11 Fan override icon

.2 Home screen non-configurable icon includes:

.1 Menu icon

.6 The network thermostat shall provide the flexibility to support any one of the following inputs:

.1 Integral indoor air temperature sensor

.2 Analog input for remote air temperature sensing that supports the following sensor types.

.1 Nickel

.2 Platinum

.3 A99B PENN

.4 2.25k ohm NTC

.5 10k ohm NTC

.6 10k ohm NTC Type 3

.3 Universal input that supports the following configurations:

.1 Analog sensor

.2 Cooling when switch is closed

.3 Heating when switch is closed

.4 Remote indoor air temperature sensor

.5 Two configurable binary inputs with the following configurations:

.1 Disabled

.2 Occupancy

.3 Override
.4 Remote PIR
.5 Dirty filter
.6 Service
.7 Fan Lock
.8 Open door
.9 Open window

.7 The network thermostat shall provide 4 digit passcode security.

.8 The network thermostat shall employ nonvolatile EEPROM for all adjustable parameters.

.9 The network thermostat shall have a temperature accuracy of ±0.9°F/±0.5°C at 70.0°F/21.0°C typical calibrated.

.10 The network thermostat shall have a humidity accuracy of ±5% RH from 20 to 80% RH at 50 to 90°F (10 to 32°C.)

.11 The network thermostat shall provide user equipment visibility from a mobile device through the MAP.

.12 On/off or floating fan coil and zoning applications:

.1 The network thermostat shall be capable of controlling two- or four-pipe fan coils, cabinet unit heaters, a pressure dependent VAV System, zoning type systems employing reheat including local hydronic reheat valves, or other similar equipment.

.2 The network thermostat shall provide the flexibility to support any one of the following fan outputs:

.1 Three speed fan control

.2 Proportional speed fan control configurable from 0 to 10V

.3 The network thermostat shall provide the flexibility to support any one of the following valve outputs:

- Two on/off

.1 Two floating

.4 The network thermostat shall provide the flexibility to adjust the following control parameters:

.1 Adjustable maximum setpoint offset from 0 to 20˚F

.2 Adjustable fan on delay from 0 to 120 seconds

.3 Adjustable fan off delay from 0 to 120 seconds

.4 Adjustable minimum cooling on time from 0 to 360 seconds

.5 Adjustable minimum cooling off time from 0 to 360 seconds

.6 Adjustable minimum heating on time from 0 to 360 seconds
.7 Adjustable minimum heating off time from 0 to 360 seconds
.8 Adjustable minimum reheat on time from 0 to 360 seconds
.9 Adjustable minimum reheat off time from 0 to 360 seconds
.10 Adjustable stroke time from 5 to 300 seconds
.11 Adjustable supply fan minimum command from 0 to 100%
.12 Adjustable supply fan Medium command from 0 to 100%
.13 Adjustable supply fan high command from 0 to 100%
.14 Adjustable reheat minimum damper position from 0 to 100%

.13 Provide Johnson Controls TEC361x or Approved Equal in accordance with frontend clause B6 as indicated on plans.

2.9 NETWORK SENSORS

.1 The Network Sensors (NS) shall have the ability to monitor the following variables as required by the systems sequence of operations:

.1 Zone Temperature
.2 Zone Humidity
.3 Zone Setpoint
.4 Discharge Air Temperature
.5 Zone CO_2

.2 The NS shall transmit the information back to the controller on the SA Bus using BACnet Standard protocol SSPC-135.

.3 The NS shall be BTL listed/certified and carry the BTL Label.

.1 The NS shall be tested and certified as a BACnet Smart Sensors (B-SS).
.2 A BACnet Protocol Implementation Conformance Statement shall be provided for the NS.
.3 The Conformance Statement shall be submitted 10 days prior to bidding.

.4 The Network Zone Temperature Sensors shall include the following items:

.1 A backlit LCD to indicate the temperature, humidity and setpoint
.2 An LED to indicate the status of the Override feature
.3 A button to toggle the temperature display between Fahrenheit and Celsius
.4 A button to program the display for temperature or humidity
.5 A button to initiate a timed override command
.6 Available in either surface mount, wall mount, or flush mount
.7 Available with either screw terminals or phone jack

.5 The Network Discharge Air Sensors shall include the following:

.1 4 inch or 8 inch duct insertion probe
.2 Ten foot pigtail lead

.3 Dip Switches for programmable address selection
.4 Ability to provide an averaging temperature from multiple locations
.5 Ability to provide a selectable temperature from multiple locations

.6 The Network CO_2 Zone Sensors shall include the following:

.1 Available in either surface mount or wall mount
.2 Available with screw terminals or phone jack
.3 Measurement range of 0-2000 ppm
.4 Sensing resolution of 1 ppm.
.5 Sensing accuracy of +/- 2% of the reading plus 40 ppm

.7 Provide Johnson Controls NS series or Approved Equal in accordance with frontend clause B6 where indicated on plans.

2.10 MISCELLANEOUS DEVICES

.1 Variable Frequency Motor Speed Control Drives

.1 The VSD and all components shall be designed, manufactured and tested in accordance with the latest applicable standards.

.1 Institute of Electrical and Electronic Engineers (IEEE)

.1 IEEE 519-1992: Guide for harmonic content and control.

.2 Underwriters Laboratories (UL508C: Power Conversion Equipment)

.1 UL

.2 cUL

.3 National Electrical Manufacturer's Association (NEMA)

.1 ICS 7.0: Industrial Controls & Systems for VSDs.

.4 EN 61000-3-12, EN 61800-3 (1996) +A11 (2000) Category C2

.1 Fulfill all EMC immunity requirements.

.2 VSD through 250 HP shall have the following features:

.1 The VSD may be designed in a NEMA Type 1, NEMA 12, or NEMA 3R enclosure

.2 Incoming Power: Three-phase, 208 / 240 / 480 (+10% to -10%) and 50/60 Hz (+10 to -5%). The VSD shall provide microprocessor-based control for three-phase induction motors. The controller's full load output current rating shall be based on a low overload application at 40°C ambient and 1.5 - 10 kHz switching frequency with automatic switching frequency de-rating in case of overload.

.3 Humidity: 0 to 95% (non-condensing and non-corrosive)

.4 Altitude: 0 to 3,300 feet (1000 meters) above sea level

.5 Ambient Temperature: -10 to 40°C (VT)

.6 Storage Temperature: -40 to 70°C

.7 The VSDs shall be of the Pulse Width Modulated (PWM) design converting the utility input voltage and frequency to a variable voltage and frequency output via a two-step operation.

.8 The VSDs shall have an efficiency at full load and speed that exceeds 97%. The efficiency shall exceed 90% at 50% speed.

.9 The VSDs shall maintain a minimum line side displacement power factor of 0.96, regardless of speed and load for VFDs less than 75 HP. The VSDs shall maintain a minimum line side displacement power factor of .99, regardless of speed and load for motors greater than 75 HP.

.10 The VSDs shall have a one (1) minute overload current rating of 110% for low overload applications.

.11 The current withstand rating of the drive shall be 100,000 AIC.

.12 The VSDs shall be capable of operating any NEMA design B squirrel cage induction motor, regardless of manufacturer, with a horsepower and current rating within the capacity of the VSD.

.13 The VSDs shall have an integral EMI/RFI filter as standard.

.14 VFD must contain a circuit breaker or fused disconnect as an option.

.15 Total harmonic distortion shall be calculated based on total demand distortion conditions as defined in IEEE 519-1992. Any harmonic calculations shall be done based on the kVA capacity, X/R ratio and the impedance of the utility transformer feeding the installation, as noted on the drawings, and the total system load.

.16 Provide built in Communication capability for interface with RS-485 (ModBus RTU) (Johnson Controls Metasys N2) (MS/TP BACnet) or Ethernet (BACnet/IP) (Modbus/TCP).

.1 Communication capability via expansion card to support RS-485 shall include Johnson Controls Metasys – SA Bus or LonWorks.

.3 Provide Johnson Controls VSD Series II or equal as indicated on plans.

.2 Local Control Panels

.1 All control panels shall be factory constructed, incorporating the BMS manufacturer's standard designs and layouts. All control panels shall be UL inspected and listed as an assembly and carry a UL 508A label listing compliance. Control panels shall be fully enclosed, with sub-panel, hinged door, and flush latch.

.2 In general, the control panels shall consist of the DDC controller(s), display module as specified and indicated on the plans, and I/O devices—such as relays, transducers, and so forth—that are not required to be located external to the control panel due to function. Where specified the display module shall be flush mounted in the panel face unless otherwise noted.

.3 All I/O connections on the DDC controller shall be provide via removable or fixed screw terminals.
.4 Low and line voltage wiring shall be segregated. All provided terminal strips and wiring shall be UL listed, 300-volt service and provide adequate clearance for field wiring.
.5 All wiring shall be neatly installed in plastic trays or tie-wrapped.
.6 Control panels for use in seismic areas shall be built in an approved facility and carry the appropriate label.
.7 Except where otherwise noted, all standard and custom control panels shall be built in an ISO9002 certified facility.

.3 Power Supplies

.1 DC power supplies shall be sized for the connected device load. Total rated load shall not exceed 75% of the rated capacity of the power supply.
.2 Input: 120 VAC +10%, 60Hz
.3 Output: 24 VDC
.4 Line Regulation: +0.05% for 10% line change
.5 Load Regulation: +0.05% for 50% load change
.6 Ripple and Noise: 1 mV rms, 5 mV peak to peak
.7 An appropriately sized fuse and fuse block shall be provided and located next to the power supply.
.8 A power disconnect switch shall be provided next to the power supply.

2.11 TEMPERATURE SENSORS

.1 General Requirements

.1 Sensors and transmitters shall be provided, as outlined in the input/output summary and sequence of operations.
.2 The temperature sensor shall be of the resistance type, and shall be either two-wire 1000 ohm nickel RTD, or two-wire 1000 ohm platinum RTD. Thermistor sensors of 10,000 or 2,250 ohms resistance may be substituted based on the application.
.3 The following point types (and the accuracy of each) are required, and their associated accuracy values include errors associated with the sensor, lead wire, and A to D conversion.

Point Type	Accuracy
Chilled Water	+ .5°F
Room Temp	+ .5°F
Duct Temperature	+ .5°F
All Others	+ .75°F

.2 Room Temperature Sensors

.1 Room sensors shall be constructed for either surface or wall box mounting.
.2 Room sensors shall have the following options when specified:

.1 Setpoint warmer/cooler

.2 Individual heating/cooling setpoint

.3 Momentary override request for activation of after-hours operation

.4 Analog thermometer

.3 Room Temperature Sensors with Integral Display

.1 Room sensors shall be constructed for either surface or wall box mounting.

.2 Room sensors shall have an integral LCD display and the following capabilities when specified:

i. Display room air temperatures

ii. Display and adjust room comfort setpoint

.1 Display and adjust fan operation status

.2 Setpoint override request via setpoint adjust dial or buttons

.3 Timed override request via occupancy override with status indication for activation of after-hours setpoint operation

.4 Occupancy sensor status

.5 Toggle between Degrees F and Degrees C

.6 Toggle between temperature and humidity where specified

.4 Thermowells

.1 Thermowell manufacturer shall have models available in stainless steel, brass body, and copper bulb.

.2 When thermowells are required, the sensor and well shall be supplied as a complete assembly, including wellhead and sensor.

.3 Thermowells shall be pressure rated and constructed in accordance with the system working pressure.

.4 Thermowells and sensors shall be mounted in a direct mount (no adapter) offering faster installation or 1/2” NFT saddle and allow easy access to the sensor for repair or replacement.

.5 Thermowells constructed of 316 stainless steel shall comply with Canadian Registration Number (CRN) pressure vessel rating.

.5 Outside Air Sensors

.1 Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall be provided with a solar shield.

.2 Sensors exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element.

.3 Temperature transmitters shall be of NEMA 3R (IP54) or NEMA 4 (IP65) construction and rated for ambient temperatures.

.4 The outdoor sensor shall be capable of being mounted on a roof, pole or side of a building utilizing its preassembled mounting bracket.

.5 Outside air relative humidity sensors 0-100% full range of accurate measurement. Operating temperature -4 to 140°F (-20 to 60°C).

.6 Outside air temperature sensors operating temperature range -40 to 140°F, +/- .55°F (+/- .3°C).

.6 Duct Mount Sensors

.1 Duct mount sensors shall mount in an electrical box through a hole in the duct, positioned to provide ease of accessibility for repair or replacement.
.2 Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate.
.3 For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be provided.
.4 Duct mount sensors shall be positioned so as to be easily accessible for repair or replacement.

.7 Averaging Sensors

.1 For ductwork greater in any dimension that 48 inches and/or where air temperature stratification exists, an averaging sensor with multiple sensing points shall be used.
.2 For plenum applications, such as mixed air temperature measurements, a continuous averaging sensor or a string of sensors mounted across the plenum shall be used to account for stratification and/or air turbulence. The averaging string shall have a minimum of 4 sensing points per 12-foot long segment.
.3 Capillary supports at the sides of the duct shall be provided to support the sensing string.
.4 Duct mount sensors shall be positioned so as to be easily accessible for repair or replacement.

.8 Acceptable Manufacturers: Johnson Controls, Minco.

2.12 HUMIDITY SENSORS

.1 The sensor shall be a solid-state type, relative humidity sensor of the Thin Film Capacitance or Bulk Polymer Design. The sensor element shall resist service contamination.
.2 The humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2-wire isolated loop powered, 4-20 mA, 0-100% linear proportional output.
.3 The humidity transmitter shall meet the following overall accuracy, including lead loss and Analog to Digital conversion. 3% between 20% and 80% RH at 77°F unless specified elsewhere.
.4 Outside air relative humidity sensors shall be installed with a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R (IP54) or NEMA 4 (IP65) enclosure with sealtite fittings.
.5 A single point humidity calibrator shall be provided, if required, for field calibration. Transmitters shall be shipped factory pre-calibrated.
.6 Duct type sensing probes shall be constructed of 304 stainless steel, and shall be equipped with a neoprene grommet, bushings, and a mounting bracket.
.7 Acceptable Manufacturers: Johnson Controls and Vaisala

2.13 CO_2 SENSORS

.1 Where shown on the drawings, CO_2 sensors shall have the following features:

.1 Jumper selectable: 0-20mA, 4-20mA & 0-10 VDC output
.2 Liquid Crystal Display (LCD)

.2 The CO_2 sensors shall have the ability to monitor and output the following variables as required by the systems sequence of operations:

.1 Zone CO_2

.3 The CO_2 shall transmit the information back to the controller via jumper selectable 0-20mA, 4-20mA & 0-10 VDC output signals:

.1 The CO_2 sensors shall provide a maximum output current of 25mA; Maximum output voltage of 12.5V.
.2 The CO_2 sensors shall be FCC compliant to CFR47 Part 15 subpart B Class A.

.4 The CO_2 sensors shall be available with:

.1 CO_2 response time (0-63%) of 1 minute
.2 Less than 0.083% of full scale/°F temperature dependence of CO_2 output
.3 Long term CO_2 stability ±5% of full scale for 5 years
.4 CO_2 measurement accuracy of ±(40ppm + 2.0% of reading)
.5 CO_2 non-linearity of less than 1.0% of full scale

.5 The CO_2 sensors may include the following items:

.1 Relay output module
.2 LCD module
.3 Analog temperature module with linear 0-10 VDC output for 32-122F

2.14 DIFFERENTIAL PRESSURE TRANSMITTERS

.1 General Air and Water Pressure Transmitter Requirements:

.1 Pressure transmitters shall be constructed to withstand 100% pressure over-range without damage, and to hold calibrated accuracy when subject to a momentary 40% over-range input.
.2 Pressure transmitters shall transmit a 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA output signal.
.3 Differential pressure transmitters used for flow measurement shall be sized to the flow sensing device, and shall be supplied with Tee fittings and shut-off valves in the high and low sensing pick-up lines to allow the balancing Contractor and The City permanent, easy-to-use connection.
.4 A minimum of a NEMA 1 housing shall be provided for the transmitter. Transmitters shall be located in accessible local control panels wherever possible.

.2 Low Differential Water Pressure Applications (0” - 20” WC):

.1 The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of flow meter differential pressure or water pressure sensing points.

.2 The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:

.1 .01-20" WC input differential pressure range

.2 4-20 mA output

.3 Maintain accuracy up to 20 to 1 ratio turndown

.4 Reference Accuracy: +0.2% of full span

.3 Acceptable Manufacturers: Setra and Mamac

.3 Medium to High Differential Water Pressure Applications (Over 21" WC):

.1 The differential pressure transmitter shall meet the low-pressure transmitter specifications with the following exceptions:

.1 Differential pressure range 10" WC to 300 PSI

.2 Reference Accuracy: +1% of full span (includes non-linearity, hysteresis, and repeatability)

.2 Standalone pressure transmitters shall be mounted in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with high and low connections piped and valved. Air bleed units, bypass valves, and compression fittings shall be provided.

.3 Acceptable Manufacturers: Setra and Mamac

.4 Building Differential Air Pressure Applications (-1" to +1" WC):

.1 The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.

.2 The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:

.1 -1.00 to +1.00 WC input differential pressure ranges. (Select range appropriate for system application)

.2 4-20 mA output

.3 Maintain accuracy up to 20 to 1 ratio turndown

.4 Reference Accuracy: +0.2% of full span

.3 Acceptable Manufacturers: Johnson Controls or Approved Equal in accordance with frontend clause B6

.5 Low Differential Air Pressure Applications (0" to 2.5" WC):

.1 The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.

.2 The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications.

.1 (0.00 - 1.00" to 5.00") WC input differential pressure ranges. (Select range appropriate for system application)

.2 4-20 mA, 0-5 VDC, 0-10 VDC output

.3 Maintain accuracy up to 20/1 ratio turndown

.4 Reference Accuracy: +0.25%, or 0.5% of full span

.3 Acceptable Manufacturers: Johnson Controls and Ruskin

.6 Medium Differential Air Pressure Applications (5" to 21" WC):

.1 The pressure transmitter shall be similar to the Low Air Pressure Transmitter, except that the performance specifications are not as severe. Differential pressure transmitters shall be provided that meet the following performance requirements.

.1 Zero & span: (c/o F.S./Deg. F): .04% including linearity, hysteresis and repeatability

.2 Accuracy: 1% F.S. (best straight line) Static Pressure Effect: 0.5% F.S. (to 100 psig)

.3 Thermal Effects: <+.033 F.S./Deg. F. over 40°F to 100°F (calibrated at 70°F)

.2 Standalone pressure transmitters shall be mounted in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with high and low connections piped and valved. Air bleed units, bypass valves, and compression fittings shall be provided.

.3 Acceptable manufacturers: Johnson Controls and Ruskin

2.15 FLOW MONITORING

.1 Air Flow Monitoring

.1 Fan Inlet Air Flow Measuring Stations

.1 At the inlet of each fan and near the exit of the inlet sound trap, airflow sensors shall be provided that shall continuously monitor the fan air volumes or velocity pressure.

.2 Each sensor shall be surface mount type. Unit shall be capable of monitoring and reporting the airflow and temperature at each fan inlet location through two or four sensing circuits. If a static pressure manifold is used, it shall incorporate dual offset static tips on the

opposing sides of the averaging manifold so as to be insensitive to flow-angle variations of as much as + 20° in the approaching air stream.

.3 Devices creating fan performance degradation, resulting in additional energy consumption, caused from pressure drop associated with probes or mounting apparatus in the center of the fan inlet are not allowed. The device shall not induce a significant pressure drop, nor shall the sound level within the duct be amplified by its singular or multiple presence in the air stream. Sensor circuit casings shall be constructed of U.L. 94 flame rated high impact ABS and include a stainless steel thermistor cap that maintains the precise calibrated flow over the heated and ambient measurement points.

.4 Acceptable manufacturers: Johnson Controls, Air Monitor Corp., Tek-Air Systems, Inc., or Dietrich Standard

.2 Single Probe Air Flow Measuring Sensor

.1 The single probe airflow-measuring sensor shall be duct mounted with an adjustable sensor insertion length of up to eight inches. The transmitter shall produce a 4-20 mA or 0-10 VDC signal linear to air velocity. The sensor shall be a thermal dispersion and utilize one temperature sensor and a heated thermistor. The sensor pair shall measure the air temperature and airflow velocity.

.3 Duct Air Flow Measuring Stations

.1 Furnish and install, at locations shown on plans or as in accordance with schedules, an equalized air measuring probe system piped to a high performance pressure transducer or an electronic type airflow temperature measuring station.

.2 Each device shall be designed and built in order to comply with, and provide results in accordance with, accepted practice as defined for system testing in the ASHRAE Handbook of fundamentals, as well as in the Industrial Ventilation Handbook.

.3 Assembly shall be AMCA tested and capable of measuring a range from 70 to 5,000 FPM (22 to 1524 MPM).

.4 Equalized air measuring assembly shall measure to ±3% average and consist of 6063T5 extruded aluminum step sensing blade(s) with anodized finish, plenum-rated polyethylene pressure tubing, brass barbed fittings, mounting hardware and a glass-on-silicone capacitance sensor pressure transducer capable of measuring up to five field-selectable pressure ranges up to 2.5 in. WC.

.5 The transducer shall be accurate to ±0.5%, or 0.25% of full scale and be contained in a National Electrical Manufacturer's Association (NEMA) 4 (IP-65) enclosure. Transducer shall be factory mounted

and piped to high and low pressure ports through fittings made of brass.

.6 All sensor tubing shall terminate in solid brass barbed fittings.

.7 Total and static pressure manifolds shall terminate with external ports for connection to control tubing. An identification label shall be present on each unit casing, listing model number, size, area, and airflow capacity.

.8 Air straightener shall be provided for sizes over 17 square feet (1.6 sq meter).

.9 Airflow measuring station assemblies shall be fabricated of galvanized steel or aluminum casing of appropriate thickness for slip fits or with 90 Deg. connecting flanges in configuration and size equal to that of the duct into which it is mounted. Each station shall be complete with an air directionalizer and parallel cell profile suppressor (3/4" maximum cell) across the entering air stream and mechanically fastened to the casing in such a way to withstand velocities up to 5000 feet per minute.

.10 Electronic air measuring station shall be capable of monitoring and reporting the airflow and temperature at each measuring location through one or more measuring probes containing multiple sensor points and a control transmitter that outputs a 4-20 mA linear signal.

.11 Probe(s) shall be constructed of an airfoil shaped aluminum extrusion containing the sensor circuit(s).

.12 Each sensor circuit shall consist of coated thermistors, for temperature and velocity, mounted to a Printed Circuit Board (PCB). Multiplexer board shall be encased to prevent moisture damage.

.13 Control transmitter shall be capable of processing independent sensing points and shall operate on a fused 24 VAC supply.

.14 Control transmitter shall feature a 16 x 2 character alphanumeric LCD screen, digital offset/gain adjustment, continuous performing sensor/transmitter diagnostics, and a visual alarm to detect malfunctions.

.15 Installation Considerations

.1 The maximum allowable pressure loss through the Flow and Static Pressure elements shall not exceed .04" WC at 1000 feet per minute, or .11" WC at 2000 feet per minute. Each unit shall measure the airflow rate within an accuracy of plus 3-5% as determined by AMCA.

.2 Where the stations are installed in insulated ducts, the airflow passage of the station shall be the same size as the inside airflow dimension of the duct. Station flanges shall be 1.5 inches to facilitate matching connecting ductwork.

.3 Where control dampers are provided as part of the airflow measuring station, parallel blade precision controlled volume dampers integral to the station and complete with actuator, and linkage shall be provided.

.4 Stations shall be installed in strict accordance with the manufacturer's published requirements, and in accordance with ASME Guidelines affecting non-standard approach conditions.

.16 All air measuring devices shall be tested according to AMCA Standard 610.

.17 Acceptable manufacturers: Johnson Controls, Air Monitor Corp., Tek-Air, Ruskin, and Dietrich Standard

.4 Static Pressure Traverse Probe

.1 Duct static traverse probes shall be provided where required to monitor duct static pressure. The probe shall contain multiple static pressure sensors located along exterior surface of the cylindrical probe.

.2 Acceptable manufacturers: Cleveland Controls

.5 Shielded Static Air Probe

.1 Where indicated on plans or in schedules a shielded static pressure probe shall be provided at each end of the building. The probe shall have multiple sensing ports, an impulse suppression chamber, and airflow shielding.

.2 Water Flow Monitoring

.1 Water flow meters shall be electromagnetic type with integral microprocessor-Based electronics. The meter shall have an accuracy of 0.25%.

.2 Acceptable manufacturers: Onicon

2.16 POWER MONITORING DEVICES

.1 Current Measurement (amps)

.1 Current measurement shall be by a combination current transformer and a current transducer. The current transformer shall be sized to reduce the full amperage of the monitored circuit to a maximum 5 Amp signal, which will be converted to a 4-20 mA DDC compatible signal for use by the Facility Management System.

.2 Current Transformer – A split core current transformer shall be provided to monitor motor amps.

.1 Operating frequency – 50 - 400 Hz

.2 Insulation – 0.6 Kv class 10Kv BIL

.3 UL recognized

.4 Five amp secondary

.5 Select current range as appropriate for application

.6 Acceptable manufacturers: Setra

.3 Current Transducer – A current to voltage or current to mA transducer shall be provided. The current transducer shall include:

.1 6X input over amp rating for AC inrushes of up to 120 amps

.2 Manufactured to UL 1244

.3 Accuracy: +.5%, Ripple +1%

.4 Minimum load resistance 30kOhm

.5 Input 0-20 amps

.6 Output 4-20 mA

.7 Transducer shall be powered by a 24 VDC regulated power supply (24 VDC +5%)

.8 Acceptable manufacturers: Setra

2.17 STATUS AND SAFETY SWITCHES

.1 General Requirements

.1 Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the Building Management System (BMS) when a failure or abnormal condition occurs. Safety switches shall be provided with two sets of contacts and shall be interlock wired to shut down respective equipment.

.2 Current Sensing Switches

.1 The current sensing switch shall be self-powered with solid-state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range.

.2 Current sensing switches shall be used for run status for fans, pumps, and other miscellaneous motor loads.

.3 Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.

.4 Acceptable manufacturers: Johnson Controls or Approved Equal in accordance with frontend clause B6

.3 Air Filter Status Switches

.1 Differential pressure switches used to monitor air filter status shall be of the automatic reset type with SPDT contacts rated for 2 amps at 120VAC.

.2 A complete installation kit shall be provided, including: static pressure tops, tubing, fittings, and air filters.
.3 Provide appropriate scale range and differential adjustment for intended service.
.4 Acceptable manufacturers: Johnson Controls, Cleveland Controls

.4 Air Flow Switches

.1 Differential pressure flow switches shall be bellows actuated mercury switches or snap acting micro-switches with appropriate scale range and differential adjustment for intended service.
.2 Acceptable manufacturers: Johnson Controls, Cleveland Controls

.5 Air Pressure Safety Switches

.1 Air pressure safety switches shall be of the manual reset type with SPDT contacts rated for 2 amps at 120VAC.
.2 Pressure range shall be adjustable with appropriate scale range and differential adjustment for intended service.
.3 Acceptable manufacturers: Johnson Controls, Cleveland Controls

.6 Water Flow Switches

.1 Water flow switches shall be equal to the Johnson Controls P74.

.7 Low Temperature Limit Switches

.1 The low temperature limit switch shall be of the manual reset type with Double Pole/Single Throw snap acting contacts rated for 16 amps at 120VAC.
.2 The sensing element shall be a minimum of 15 feet in length and shall react to the coldest 18-inch section. Element shall be mounted horizontally across duct in accordance with manufacturers recommended installation procedures.
.3 For large duct areas where the sensing element does not provide full coverage of the air stream, additional switches shall be provided as required to provide full protection of the air stream.
.4 The low temperature limit switch shall be equal to Johnson Controls A70.

2.18 CONTROL RELAYS

.1 Control Pilot Relays

.1 Control pilot relays shall be of a modular plug-in design with retaining springs or clips.
.2 Mounting Bases shall be snap-mount.
.3 DPDT, 3PDT, or 4PDT relays shall be provided, as appropriate for application.
.4 Contacts shall be rated for 10 amps at 120VAC.
.5 Relays shall have an integral indicator light and check button.

.6 Acceptable manufacturers: Johnson Controls, Lectro

.2 Lighting Control Relays

.1 Lighting control relays shall be latching with integral status contacts.
.2 Contacts shall be rated for 20 amps at 277 VAC.
.3 The coil shall be a split low-voltage coil that moves the line voltage contact armature to the On or Off latched position.
.4 Lighting control relays shall be controlled by:

.1 Pulsed Tristate Output – Preferred method.

.2 Pulsed Paired Binary Outputs.

.3 A Binary Input to the Facility Management System shall monitor integral status contacts on the lighting control relay. Relay status contacts shall be of the "dry-contact" type.

.5 The relay shall be designed so that power outages do not result in a change-of-state, and so that multiple same state commands will simply maintain the commanded state. Example: Multiple Off command pulses shall simply keep the contacts in the Off position.

2.19 ELECTRONIC SIGNAL ISOLATION TRANSDUCERS

.1 A signal isolation transducer shall be provided whenever an analog output signal from the BMS is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input signal from a remote system.

.2 The signal isolation transducer shall provide ground plane isolation between systems.

.3 Signals shall provide optical isolation between systems.

.4 Acceptable manufacturers: Advanced Control Technologies

2.20 ELECTRONIC/PNEUMATIC TRANSDUCERS

.1 Electronic to Pneumatic transducers shall provide:

.1 Output: 3-15 psig
.2 Input: 4-20 mA or 0-10 VDC
.3 Manual output adjustment
.4 Pressure gauge
.5 External replaceable supply air filter

.2 Acceptable manufacturers: Johnson Controls, Mamac

2.21 THERMOSTATS – ELECTRIC

.1 Electric room thermostats of the heavy-duty type shall be provided for unit heaters, cabinet unit heaters, and ventilation fans, where required. All these items shall be

provided with concealed adjustment. Finish of covers for all room-type instruments shall match and, unless otherwise indicated or specified, covers shall be manufacturer's standard finish.

.2 Acceptable Manufacturers: Penn, Emerson, Honeywell

2.22 SMOKE DETECTORS

.1 Ionization type air duct detectors shall be furnished as specified elsewhere in Division 26 for installation under Division 23. All wiring for air duct detectors shall be provided under Division 26, Fire Alarm System.

2.23 ACTUATORS AND OPERATORS

.1 General Requirements

.1 Actuators shall be electronic or pneumatic, or both, as detailed in the following sections.
.2 The manufacturer shall be ISO 9001 certified.

.2 Electronic Damper Actuators

.1 Spring Return Actuators:

.1 Spring Return Actuators shall be manufactured, brand labelled and distributed by Johnson Controls or an approved equivalent.

.2 Spring Return Actuators shall comply with the following regulatory agency listings: cULus, CSA C22.2 No24-93, and CE marked. Asia Pacific (APAC) actuators shall be excluded from this regulatory information.

.3 Spring Return Actuators shall be of direct-coupled design and require no crank arm or linkage for mounting to a shaft.

.4 Spring Return Actuators shall offer a coupling method which requires a toothed V-bolt clamp and nuts with toothed cradle.

.5 Spring Return Actuators shall be configured for reversible mounting which provides either clockwise or counter clockwise operation.

.6 Spring Return Actuators power failure operation shall configure upon a loss of electric power to the actuator, a mechanical spring return system shall drive the actuator to the failsafe home position. Other forms of internal energy storage for power failure operation shall not be acceptable.

.7 Spring Return Actuators shall utilize the following motor technology:

.1 Modulating types: Microprocessor-controlled brushless DC motors

.2 On/Off types: DC brush motor

.8 Spring Return Actuators shall be furnished with Electronic Stall Detection which protects the actuator from overload at all angles of rotation without the need for end switches.

.9 Spring Return Actuators shall comply with enclosure ratings of NEMA type 2 or IP54 mounted in any orientation.

.10 Spring Return Actuators shall eliminate the need for electrical ground wires for double-insulated construction.

.11 Spring Return Actuators shall be furnished with integral cables with colored and numbered conductors for simplified wiring.

.12 Spring Return Actuators shall be sized for the torque required to seal the damper at load conditions.

.13 Spring Return Actuators shall be available in parallel operation that are capable of being mechanically or electrically paralleled.

.14 Proportional actuators shall be user configurable without the use of external computer software or programming tools. Calibration, input signal range selection, and control logic reversal shall be selectable with an external mode selection switch.

.15 Spring Return Actuators shall operate in the following temperature ranges:

.1 For a 70 lb·in. torque actuator range must be -40°F to 140°F (-40°C to 60°C)

.2 For a 177 lb·in. torque actuator range must be -40°F to 131°F (-40°C to 55°C)

.16 Spring Return Actuators shall be provided with the following power requirements:

.1 Modulating types:

.1 A torque of 27 lb·in. has a 6VA maximum

.2 A torque of 70 lb·in. has an 8VA maximum

.3 A torque of 177 lb·in. has a 16VA maximum

.2 Two-position types:

.1 A torque of 27 lb·in. has a 6VA maximum

.2 A torque of 70 lb·in. has an 8VA maximum

.3 A torque of 177 lb·in. has a 25VA maximum

.2 Non-Spring Return Actuators

.1 Non-Spring Return (NSR) actuators shall be manufactured, brand labelled or distributed by Johnson Controls or an approved equivalent. The NSR actuators are manufactured under International Standards Organization (ISO) 9001 Quality Control Standards to ensure quality.

.2 NSR actuators shall comply with the following regulatory agency listings: cULus, CSA C22.2 No 24-93, and CE marked. APAC actuators are excluded from this regulatory information.

.3 NSR actuators shall be provided with a 5 year warranty from the date of sale. Actuators sold in the APAC region shall comply with an 18 month warranty policy.

.4 NSR actuators shall be of direct-coupled design and require no crank arm or linkage for mounting to a shaft.

.5 NSR actuators shall be of a design that converts the damper version to the valve version without the use of special tools.

.6 NSR actuators shall be configured for direct mounting and will not require any damper linkage. Actuators can be mounted directly with a universal clamp to the following:

.1 Round damper shaft from 3/8 in. (10mm) up to 1 in. to 1/16 in. (27mm)

.2 Square damper shaft from 3/8 in. (10mm) up to 3/4 in. (19mm)

.7 NSR actuators shall feature an optional NEMA 4X/IP66 weather shield for applications in harsh environments

.8 NSR actuators shall be furnished such that the actuator complies with the following control signals:

.1 The NSR actuators shall be available in models that accept input signal controls for on/off, floating, and proportional control.

.2 The NSR actuators shall operate with an automatic signal input detection which allows automatic recognition of input signals for on/off, floating and proportional control. They shall be equipped with adjustable span automatic controls that require no special tools.

.3 In proportional mode, the actuator shall respond to control signals DC 0 V to 10 V or DC 2 to 10 V.

.4 When a 500 ohm resistor is added in proportional mode, the actuator shall respond to a 0 mA to 20 mA or 4 to 20mA signal. A feedback signal of DC 0 V to 10 V or DC to 10 V indicates position.

.9 NSR actuators shall be available in line voltage On/Off and floating models to offer reduced total installation cost by avoiding installation of external power supply adapters.

.10 NSR actuators shall be available in high speed On/Off and floating models for applications in loop that require a quick response time.

.11 NSR actuators shall offer optional auxiliary switches to provide the following:

.1 Two line-voltage-capable single-pole, double-throw (SPDT) switches with continuously adjustable switch points

.2 An auxiliary potentiometer kit provides and potentiometer feedback options for improving the safety, interface and signal

.12 NSR actuators shall be furnished with the option of backward compatible to produce a seamless retrofit without the need to replace the controller.

.13 NSR actuators shall have the option to be furnished with a plenum-rated cable which are specially configured for installation in spaces used for environmental air-handling purposes, other than ducts and plenums, as specified in National Fire Protection Association (NFPA) 70: National Electrical Code section 300.22(C), Other Space Used for Environmental Air.

.14 NSR actuators shall have a constant runtime which is independent of supply voltage frequency and load.

.15 NSR actuators for Floating and On/Off models for line voltage (AC 85 to 264 V) for standard speed applications shall operate with AC 85 to 264 V and provide the rated torque. The actuators shall be designed to provide constant runtime, independent of supply voltage frequency and load.

.16 NSR actuators for Floating and On/Off models for AC/DC 24 V for high speed applications shall have an 8-second constant runtime, independent of supply voltage frequency and load.

.17 NSR actuators shall be furnished with electronic stall detection which protects the actuator from overload at all angles of rotation. The actuator may be stalled anywhere in its rotation range without the need for mechanical end switches.

.18 NSR actuators shall be equipped with microprocessor-controlled brushless DC motors which provides constant runtime independent of torque and increases the actuators lifecycle by reducing water.

.19 NSR Actuators shall have the option of a bottom-mounted coupler which simplifies short shaft damper applications.

.20 NSR actuators shall offer multiple shaft coupling methods:

.1 For units above 80 lb·in a toothed V-bolt clamp and nuts with a toothed cradled shall be used.

.2 For units 80 lb·in. and below use a single-cup-point set screw and toothed cradle shall be used.

.21 NSR actuators shall be furnished with a Minimum IP (ingress protection) enclosure ratings as follows:

.1 Actuator for types with covered wiring terminals shall be furnished as NEMA type 2/IP42 mounted in any orientation.

.2 Actuators for types without a covered wiring terminal shall be furnished with a NEMA type 1/IP30 or IP40.

.3 Actuators for types with integrated cables shall be furnished as NEMA type 2/IP42 mounted in any orientation.

.4 NSR actuators shall be furnished with a minimum IP (ingress protection) rating of no lower than IP42, but also be available in NEMA5/IP54.

.22 NSR actuators shall be able to operable in a temperature range of -4°F to 122°F (-20°C to 50°C) except for VAV and similar indoor applications in which 32°F to 122°F (0°C to 50°C) is acceptable

.23 NSR actuators shall be provided with the following power requirements:

.1 24 V with models available for both 24 VAC and 24 VDC operation (maximum)

.2 For NSR actuators above 80 lb·in. a maximum of 7.5 VA at 24 VAC

.3 For NSR actuators 80 lb·in. or below a maximum of 3.5 VA at 24 VAC

.24 NSR actuators shall be sized for the torque required to seal the damper at load conditions. For NSR actuators in parallel operation, actuators shall be available that are capable of being mechanically or electrically paralleled automatically.

.25 NSR proportional actuators shall be user configurable without requiring the use of external computer software or programming tools.

.26 NSR actuators shall also be furnished with the option of backward compatible auxiliary switch kits and auxiliary potentiometers which allow for a seamless retrofit without the needs to replace the controller.

2.24 CONTROL VALVES

.1 Ball Valves, 1/2 through 2 in.

.1 Ball Valves shall have forged brass bodies.

.2 Valves shall have available either Chrome Plated Brass Balls or 300 Series Stainless Steel Balls in all sizes.

.3 Valves shall have available either Nickel Plated Brass Stems or 300 Series Stainless Steel Stems with a blow-out proof stem design in all sizes.

.4 Valves shall have Graphite reinforced Polytetrafluoroethylene (PTFE) seats with Ethylene Propylene Diene Monomer (EPDM) O-ring backing.

.5 Stem seals shall be double EPDM O-rings.
.6 Flow Characterization Disk shall be manufactured from Amodel AS-1145HS Polyphthalamide Resin and rated for 50 psi maximum differential pressure and shall be inserted against the casting of the valve.
.7 All ball valves with internal pipe thread end connections shall be rated to 580 psi maximum static pressure at 203°F (95°C) fluid temperature.
.8 All ball valves with sweat end connections or press end connection shall be rated to 300 psig maximum static pressure at 203°F (95°C) fluid temperature.
.9 All valves shall be rated for service with hot water, chilled water and 50% glycol solutions.
.10 Ball Valves with stainless steel balls and stems shall be rated for use with 15 psig saturated steam.
.11 Flow Characteristics shall be equal percentage on the control port. Bypass port on three-way valves shall have linear flow characteristics.
.12 Valves shall have a maximum leakage specification of 0.01% of maximum flow for the control port, ANSI/FCI 70-2, Class 4 and 1% of maximum flow, bypass port.
.13 Valves shall be maintenance free.
.14 Valves shall be provided with a 5 year equipment warranty.
.15 Valves shall be rated for 200 psi differential closeoff pressure.
.16 Valve actuators shall be UL-recognized or CSA-certified.
.17 Valves shall be Johnson Controls VG1000 Series ball valves or Approved Equal in accordance with frontend clause B6.

.2 Butterfly Valves, High Performance 2-1/2 through 16 in.

.1 Butterfly valve shall have bodies manufactured from carbon steel, ASTM A216 GR WCB/A516 GR 70 and shall be fully lugged per ASME Class 150 or ASME Class 300.
.2 Valve seat assemblies shall be RPTFE (reinforced polytetrafluorethylene) and the seat retainer shall be carbon steel, ASTM A516 GR 70.
.3 Valve disks shall be stainless steel, ASTM A 351 GR CF8M.
.4 Valve stems shall be 17-4 PH stainless steel, ASTM A564-Type 630.
.5 Stem seals shall be one carbon fibre ring and three TFE rings.
.6 Flow characteristics shall be equal percentage up to 70° of disk rotation.
.7 Valves shall be rated for service with hot water, chilled water, 50% glycol solutions and 50 psig (kPa) saturated steam in modulating service or 150 psig (kPa) saturated steam in two position service.
.8 Valves shall meet the performance requirements of the ASMA Class 150 and Class 300.
.9 Valves shall be maintenance free.
.10 Valves shall be provided with a 3 year warranty. Valves sold in the APAC region shall comply with an 18 month warranty policy.
.11 Valves shall be UL–recognized or CSA-certified. APAC valves shall be excluded from this regulatory information.

.12 Valves shall be Johnson Controls VF Series Butterfly Valves or Approved Equal in accordance with frontend clause B6.

2.25 CONTROL DAMPERS

.1 The BMS Contractor shall furnish all automatic dampers. All automatic dampers shall be sized for the application by the BMS Contractor or as specifically indicated on the drawings.

.2 All dampers used for throttling airflow shall be of the opposed blade type arranged for normally open or normally closed operation, as required. The damper is to be sized so that, when wide open, the pressure drop is a sufficient amount of its close-off pressure drop to shift the characteristic curve to near linear.

.3 All dampers used for two-position, open/close control shall be parallel blade type arranged for normally open or closed operation, as required.

.4 Damper frames and blades shall be constructed of either galvanized steel or aluminum. Maximum blade length in any section shall be 60”. Damper blades shall be 16-gauge minimum and shall not exceed eight (8) inches in width. Damper frames shall be 16-gauge minimum hat channel type with corner bracing. All damper bearings shall be made of reinforced nylon, stainless steel or oil-impregnated bronze. Dampers shall be tight closing, low leakage type, with synthetic elastomer seals on the blade edges and flexible stainless steel side seals. Dampers of 48”x48” size shall not leak in excess of 8.0 cfm per square foot when closed against 4” WC static pressure when tested in accordance with AMCA Std. 500.

.5 Airfoil blade dampers of double skin construction with linkage out of the air stream shall be used whenever the damper face velocity exceeds 1500 FPM or system pressure exceeds 2.5” WC, but no more than 4000 FPM or 6” WC.

.1 Acceptable manufacturers are Johnson Controls VD-1250, VD1630, or VD-1330, Ruskin CD50 or CD60, and Vent Products 5650.

.6 One piece rolled blade dampers with exposed or concealed linkage may be used with face velocities of 1500 FPM or below.

.1 Acceptable manufacturers: Johnson Controls VD-1620, VD-1320, Ruskin CD36, and Vent Products 5800.

.7 Multiple section dampers may be jack-shafted to allow mounting of piston pneumatic actuators and direct connect electronic actuators. Each end of the jackshaft shall receive at least one actuator to reduce jackshaft twist.

2.26 STAND-ALONE GAS MONITOR

.1 Units shall be certified to ANSI/UL 61010-1 and CSA-C22.2 No. 61010-1 standards.

.2 Manufacturer shall be certified ISO-9001-2000.

.3 Stand-Alone Monitor:

.1 The monitor will be powered by 24 Vac or by an external power supply rated at 24 Vdc. The Monitor will incorporate an Electrochemical cell for toxic gas monitoring and Catalytic bead for combustibles.

.2 The monitor will be capable of transmitting gas concentrations to a DDC system through its 4-20 mA output. For local activation of fans or louvers (or other equipment), two on-board DPDT relays 5 A, 30 Vdc or 250 Vac (resistive load) will be activated at programmable set points (and programmable before and after time delays, alarm silence and alarm reset parameters). An 8 character, 2 line backlit LCD display will provide local gas concentration readings.

.3 Transmitter will be capable of operating within relative humidity ranges of 5-95% non-condensing and temperature ranges of -4° F to 122° F (-20° C to 50° C).

.4 The transmitter will have a plug-in capability for a gas cartridge with a smart sensor technology with self-testing capabilities accuracy of +/- 3%of full scale @ 25 C.

.5 Enclosure will be Polycarbonate with rubberized sealed cover and LED visual indications for power, alarm & fault conditions.

.6 For local activation of audible alarms, the monitor shall have an on-board device able to generate an audible output of 85 dBA @ 10 ft (3m).

.7 Monitor alarm levels are to activate and the unit is to be installed in accordance with the following parameters:

COMBUSTIBLE GASES	FIRST ALARM SET POINT (TLV-TWA)	SECOND ALARM SET POINT (TLV-STEL)	SENSOR LOCATION	RADIUS OF COVERAGE
Carbon Monoxide	12 ppm	25ppm	4-5 feet from floor	50 feet

.8 Acceptable Products:

.9 Honeywell Analytics Model E3SASCO or Approved Equal in accordance with frontend clause B6.

2.27 BOILER PLANT CONTROLLER

.1 Smart boiler controller capable of operating 4 boilers in a central heating with outdoor reset configuration.

.2 Features:

.1	Packaged weight:	3.3 lb. (1500 g)
.2	Dimensions:	9" H x 8" W x 2-11/32" D (229 x 203 x 60 mm)
.3	Display:	5" color touchscreen
.4	Enclosure:	Blue ABS plastic, NEMA type 1
.5	Approvals:	CSA C US, FCC Part 15B, ICES-003 Class A
.6	Ambient conditions:	Indoor use only, 32 to 122°F (0 to 50°C), RH ≤90% non-condensing, Altitude < 6560 feet (2000 m), Installation Category II, Pollution Degree 2.
.7	Power supply:	115 V (ac) ±10%, 60 Hz, 9 W
.8	Relays:	230 V (ac), 5A, 1/3 hp
.9	Modulating outputs:	0-10 V (dc) 500 Ω minimum load impedance or 4-20 mA 1 kΩ max load impedance
.10	Calls:	24 V (ac) or Short
.11	Sensor:	NTC thermistor, 10 kΩ @ 77°F (25°C ±0.2°C) ß=3892 Outdoor Sensor 070, Universal Sensor 082
.12	Communications:	10/100 Ethernet, WiFi 802.11n, 2.4 GHz, WPA2 encryption
.13	Warranty:	Limited 3 Year

.3 Acceptable Product:

.1 Tekmar Smart Boiler Control 294 or Approved Equal in accordance with frontend clause B6.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 BMS SPECIFIC REQUIREMENTS

.1 Graphic Displays

.1 Provide a color graphic system flow diagram display for each system with all points as indicated on the point list. All terminal unit graphic displays shall be from a standard design library.

.2 User shall access the various system schematics via a graphical penetration scheme and/or menu selection.

.2 Custom Reports:

.1 Provide custom reports as required for this project.

.3 Actuation / Control Type

.1 Primary Equipment
  .1 Controls shall be provided by equipment manufacturer as specified herein.
  .2 All damper and valve actuation shall be electric.
.2 Air Handling Equipment
  .1 All air handlers shall be controlled with a HVAC-DDC Controller.
  .2 All damper and valve actuation shall be electric.
.3 Terminal Equipment:
  .1 Terminal Units (FC, etc.) shall have electric damper and valve actuation.
  .2 All Terminal Units shall be controlled with HVAC-DDC Controller

3.3 INSTALLATION

.1 Install control devices to manufacturers instructions.

.2 Install remote sensing device and capillary tube in rigid, metallic conduit. Conduit enclosing capillary tube must not touch heater or heating cable.

.3 High and low limit thermostats, high-pressure cut-offs, and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches shall require manual reset. Provide contacts that allow DDC software to monitor safety switch status.

  .1 General:
  .1 Install sensors according to manufacturer's recommendations.
  .2 Mount sensors rigidly and adequately for operating environment.
  .3 Air seal wires attached to sensors in their raceways or in the wall to prevent sensor readings from being affected by air transmitted from other areas.

.4 Thermostats & Space Sensors:

  .1 For areas requiring barrier free access or along barrier free paths of travel:
    .1 Install thermostat 48” (1200 mm) above finished floor, and
    .2 Install a remote temperature sensor above thermostat, 55” – 59” (1400 – 1500 mm) above finished floor.
    .3 Thermostat shall sense room temperature from remote temperature sensor.
  .2 For non-barrier free access:
    .1 Install thermostat 55” – 59” (1400 – 1500 mm) above finished floor
  .3 On outside walls, mount thermostats on standoff brackets or insulated pad 1” (25mm) from exterior wall.
  .4 Install room temperature sensors on concealed junction boxes properly supported by wall framing.

.5 BMS Wiring

.1 All conduit, wiring, accessories and wiring connections required for the installation of the BMS, as herein specified, shall be provided by the BMS Contractor unless specifically shown on the Electrical Drawings under Division 24 Electrical. All wiring shall comply with the requirements of applicable portions of Division 24 and all local and national electric codes, unless specified otherwise in this section.

.2 All BMS wiring materials and installation methods shall comply with BMS manufacturer recommendations.

.3 The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the BMS Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the BMS Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.

.4 Class 2 Wiring

.1 All Class 2 (24 VAC or less) wiring shall be installed in conduit unless otherwise specified.

.2 Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5’ from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.

.5 Class 2 signal wiring and 24 VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.

.6 Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.

.6 BMS Line Voltage Power Source

.1 120-volt AC circuits used for the BMS shall be taken from panel boards and circuit breakers provided by Division 26.

.2 Circuits used for the BMS shall be dedicated to the BMS and shall not be used for any other purposes.

.3 DDC terminal unit controllers may use AC power from motor power circuits.

.7 BMS Raceway

.1 All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size 1/2”.

.2 Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Contract Administrator.

.3 All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.

.4 Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed.

.8 Penetrations

.1 Provide fire stopping for all penetrations used by dedicated BMS conduits and raceways.

.2 All openings in fire proofed or fire stopped components shall be closed by using approved fire resistive sealant.

.3 All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway.

.4 Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.

.9 BMS Identification Standards

.1 Node Identification. All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location.

.2 Cable types specified in Item A shall be color coded for easy identification and troubleshooting.

.10 BMS Panel Installation

.1 The BMS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.

.2 The BMS Contractor shall be responsible for coordinating panel locations with other trades and electrical and Mechanical Subcontractors.

.11 Input Devices

.1 All Input devices shall be installed per the manufacturer recommendation.

.2 Locate components of the BMS in accessible local control panels wherever possible.

.12 HVAC Input Devices – General

.1 All Input devices shall be installed per the manufacturer recommendation.

.2 Locate components of the BMS in accessible local control panels wherever possible.

.3 The Mechanical Subcontractor shall install all in-line devices such as temperature wells, pressure taps, airflow stations, etc.

.4 Input Flow Measuring Devices shall be installed in strict compliance with ASME guidelines affecting non-standard approach conditions.

.5 Outside Air Sensors

.1 Sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outdoor air conditions accurately.

.2 Sensors shall be installed with a rain proof, perforated cover.

.6 Pipe Mounted Temperature Sensors:

.1 Install pipe-mounted temperature sensors in wells. Install liquid temperature sensors with heat-conducting fluid in thermal wells.

.7 Water Differential Pressure Sensors

.1 Differential pressure transmitters used for flow measurement shall be sized to the flow-sensing device.

.2 Differential pressure transmitters shall be supplied with tee fittings and shut-off valves in the high and low sensing pick-up lines.

.3 The transmitters shall be installed in an accessible location wherever possible.

.8 Medium to High Differential Water Pressure Applications (Over 21” WC)

.1 Air bleed units, bypass valves and compression fittings shall be provided.

.9 Building Differential Air Pressure Applications (-0.5” to +0.5” WC)

.1 Transmitters exterior sensing tip shall be installed with a shielded static air probe to reduce pressure fluctuations caused by wind.

.2 The interior tip shall be inconspicuous and located as shown on the drawings.

.10 Air Flow Measuring Stations

.1 Where the stations are installed in insulated ducts, the airflow passage of the station shall be the same size as the inside airflow dimension of the duct.

.2 Station flanges shall be two inch to three inch to facilitate matching connecting ductwork.

.11 Duct Temperature Sensors

.1 Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.

.2 The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.

.3 For ductwork greater in any dimension than 48 inches or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor.

.4 The sensor shall be mounted to suitable supports using factory approved element holders.

.12 Low Temperature Limit Switches

.1 Install on the discharge side of the first water or steam coil in the air stream.

.2 Mount element horizontally across duct in a serpentine pattern ensuring each square foot of coil is protected by 1 foot of sensor.

.3 For large duct areas where the sensing element does not provide full coverage of the air stream, provide additional switches as required to provide full protection of the air stream.

.13 Air Differential Pressure Status Switches

.1 Install with static pressure tips, tubing, fittings, and air filter.

.14 Water Differential Pressure Status Switches

.1 Install with shut off valves for isolation.

.15 HVAC Output Devices

.1 All output devices shall be installed per the manufacturers' recommendation. The Mechanical Subcontractor shall install all in-line devices such as control valves, dampers, airflow stations, pressure wells, etc.

.2 Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke. When any pneumatic actuator is sequenced with another device, pilot positioners shall be installed to allow for proper sequencing.

.3 Control Dampers: Shall be opposed blade for modulating control of airflow. Parallel blade dampers shall be installed for two position applications.

.4 Control Valves: Shall be sized for proper flow control with equal percentage valve plugs. The maximum pressure drop for water applications shall be 5 PSI. The maximum pressure drop for steam applications shall be 7 PSI.

.5 Electronic Signal Isolation Transducers: Whenever an analog output signal from the BMS is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input a signal from a remote system, provide a signal isolation transducer. Signal isolation transducer shall provide ground plane isolation between systems. Signals shall provide optical isolation between systems.

3.4 PROJECT SPECIFIC REQUIREMENTS

.1 The Contractor shall provide but not necessarily be limited to the design, network management, device and controller materials supply, installation, start-up and commissioning for the systems as illustrated and herein described.

.2 Responsibility for mounting and connecting including providing required wiring methods for control devices, remote control panels, etc. that are supplied lose with packaged equipment.

.3 Mechanical Systems Minimum Control & Control Panel Function:

.1 Control to design sequence of operation,
.2 Status Displays,
.3 Alarming.

.4 As a minimum all control wiring shall be run in EMT conduit, unless otherwise dictated by Code. The more restrictive requirements shall apply.

.5 All equipment shall be capable of operating independent of DDC controls to facilitate maintenance and testing in HAND mode.

.6 Device Listing:

.1 Boiler Packaged Controls,
  .1 Low water cut-offs.
.2 Boiler Plant Controller,
  .1 Outdoor air reset controller,
  .2 Outside air temperature sensor.
.3 Chiller Packaged Controls,
.4 Pump Packaged Controls,
.5 AHU Packaged Controls,
.6 Condensing Unit Packaged Controls,
.7 Thermostats,
.8 Flow Switches
.9 Humidity sensors,
.10 Control valves,
.11 Air and water temperature sensors,
.12 Air and water pressure sensors,
.13 Current sensing relays,
.14 Flow switches,
.15 Stand Alone Gas Monitor,
.16 Motorized Dampers and Actuators.

3.5 SEQUENCE OF OPERATION

.1 Hot Water Heating Boiler Operation, B-01 & B-02:

.1 Boiler plant shall be enabled at an outdoor temperature below 12 degrees Celsius (adjustable), boilers shall be disabled when outdoor air temperatures exceed 15 degrees Celsius (adjustable).
.2 The boilers, when enabled, shall operate through the boiler plant controller and packaged operating and safety controls to maintain a hot water supply

temperature, as sensed by supply header hot water temperature sensor, dependent on an outdoor air reset schedule; outdoor air reset schedule is dependent on boiler plant controller packaged outside air temperature sensor; outdoor air reset controller is integral with boiler plant controller.

.3 Packaged safety controls, i.e. low water cut-off, flow switch, temperature high-limit and gas train safeties are provided with the boilers.

.4 The boiler's are 100% redundant and shall operate in a lead-lag fashion, controlled by the boiler plant controller. Fixed lead boiler shall be user adjustable. Confirm lead boiler for *Substantial Completion* with Contract Administrator and The City.

.5 All boiler alarms shall be included in boiler controller from manufacturer.

.6 BMS shall be capable of displaying boiler status and all alarms.

.2 Electric Boiler Circulation Pump, BP-01:

.1 Boiler circulation pump shall be energized by its respective boiler factory controls. Pump VFD shall be used for balancing purposes only.

.2 Pump operation shall be proven by flow switch. If flow is not proven, alarm shall be sent to BMS.

.3 BMS shall be capable of displaying pump status.

.3 Natural Gas-Fired Boiler Circulation Pumps, BP-02:

.1 Boiler circulation pump VFD shall be controlled by its respective boiler factory controls. Boiler shall send the same 0-10 V signal used to modulate the burner section to the pump VFD such that the firing rate and pumping rate are synchronized over the firing rate of the boiler.

.2 Pump operation shall be proven by flow switch. If flow is not proven, alarm shall be sent to BMS.

.3 BMS shall be capable of displaying pump status.

.4 Hydronic Heating System Circulation Pumps, CP-01 & CP-02:

.1 Pumps shall operate in parallel shared load mode, based on their factory controls. Pump operation to be proven with associated flow switch.

.2 Pump VFDs shall be factory mounted and programmed. Pumps shall not require the use of a remote DP sensor to control pump speed and respond to varying load through factory controls.

.3 Provide parallel pump controller for parallel operation.

.4 Pump operation shall be proven by flow switch. If flow is not proven, alarm shall be sent to BMS.

.5 BMS shall be capable of displaying pump status and all alarms.

.5 Glycol Heating Circulation Pumps, GP-01 & GP-02:

.1 Pumps shall operate in parallel shared load mode, based on their factory controls. Pump operation to be proven with associated flow switch.

.2 Pump VFDs shall be factory mounted and programmed. Pumps shall not require the use of a remote DP sensor to control pump speed and respond to varying load through factory controls.
.3 Provide parallel pump controller for parallel operation.
.4 Pump operation shall be proven by flow switch. If flow is not proven, alarm shall be sent to BMS.
.5 BMS shall be capable of displaying pump status and all alarms.

.6 Hydronic Cooling System Circulation Pumps, CWP-01 & CWP-02:

.1 Pumps shall operate in parallel shared load mode, based on their factory controls. Pump operation to be proven with associated flow switch.
.2 Pump VFDs shall be factory mounted and programmed. Pumps shall not require the use of a remote DP sensor to control pump speed and respond to varying load through factory controls.
.3 Provide parallel pump controller for parallel operation.
.4 Pump operation shall be proven by flow switch. If flow is not proven, alarm shall be sent to BMS.
.5 BMS shall be capable of displaying pump status and all alarms.

.7 Fan Coils:

.1 Provide 3-way modulating control valves and lockable, tamper-proof space thermostats for fan coils as indicated on the drawings. Provide one (1) control valve for each of the heating and cooling coils; two (2) per fan coil. The fan coils shall be controlled through low voltage lockable, tamper-proof thermostats supplied by the Control Contractor. Provide control cabling to allow the thermostats to be mounted as indicated on drawings. Thermostat shall communicate with DDC system and shall be capable of displaying status and being programed through DDC system.
.2 The BAS DDC controller is to contain a weekly schedule which is used to set the occupied and unoccupied operation of the system.
.3 The BAS DDC controller is also to contain an annual calendar which is used to set the days of operation for the building.
.4 Occupied Operation
.1 Supply Fan:
.1 Fan shall be on, constant volume.
.2 Heating Mode:
.1 During heating mode, the air handler operates based on their factory-installed controls.
.2 FC controller to modulate hydronic heating control valve to meet space temperature set point. Hydronic cooling control valve shall be in full by-pass.
.3 For rooms served by Fan Coils containing Perimeter Radiation System (BB-#), 2-way control valve on Perimeter

Radiation System shall modulate with FC three way valve to maintain common setpoint from common room thermostat.

.3 Cooling Mode:

.1 During cooling mode, the air handler operates based on their factory-installed controls.

.2 FC controller to modulate hydronic cooling control valve to meet space temperature set point. Hydronic heating control valve shall be in full by-pass.

.3 For rooms served by Fan Coils containing Perimeter Radiation System (BB-#), 2-way control valve on Perimeter Radiation System shall be closed.

.5 Unoccupied Operation

.1 During unoccupied operation the fans are disabled, and the mixed air dampers are set to full return air.

.2 Heating Mode:

.1 For rooms served by Fan Coils containing Perimeter Radiation System (BB-#), 2-way control valve on Perimeter Radiation System shall modulate to maintain setpoint of 18°C (adjustable) from common room thermostat.

.2 Should any of the space temperature sensors drop below 15°C (adjustable), the fans are enabled and heating mode operation is enabled until the space temperatures rise above 18°C (adjustable), after which normally scheduled operation resumes.

.6 Alarms

.1 Supply fan failure

.2 Low limit (hard wired)

.3 Condensing unit fault

.8 Perimeter Radiation System (BB-#):

.1 Provide 2-way modulating control valves and lockable, tamper-proof space thermostats for radiation units as indicated on the drawings. The perimeter finned tube radiation shall be controlled through low voltage lockable, tamper-proof thermostats supplied by the Control Contractor. Provide control cabling to allow the thermostats to be mounted as indicated on drawings. Thermostat shall communicate with DDC system and shall be capable of displaying status and being programed through DDC system.

.9 Cabinet Force Flow Heater System (FF-#):

.1 Confirm operation of fan control by air temperature, unit mounted thermostat monitors air temperature in the space for heating. When the air temperature drops below an adjustable setpoint temperature, the fan

blower will start. When the air temperature is satisfied, the blower will shut off. Provide control cabling to allow the thermostat to be mounted as indicated on drawings. Thermostat provides local control only.

.10 Unit Heater Systems (UH-#):

.1 Provide 2-way modulating control valves and lockable, tamper-proof space thermostats for unit heaters as indicated on the drawings. The unit heaters shall be controlled through low voltage lockable, tamper-proof thermostats supplied by the Control Contractor. When the air temperature drops below an adjustable setpoint temperature, the fan blower will start. When the air temperature is satisfied, the blower will shut off. Provide control cabling to allow the thermostats to be mounted as indicated on drawings. Thermostats shall communicate with DDC system and shall be capable of displaying status and being programed through DDC system.

.11 Air Cooled Chiller Operation, CH-01:

.1 Chiller shall be enabled at an outdoor temperature above 0 degrees Celsius (adjustable), chiller shall be disabled when outdoor air temperatures drop below -5 Celsius (adjustable).

.2 The chiller, when enabled, shall operate through their packaged operating and safety controls to maintain a chilled glycol supply temperature, as sensed by a temperature sensor, of 6.7°C (Adjustable).

.3 The chiller shall be capable of controlling its packaged chilled glycol circulation pumps as well as alternating cooling modes (Compressor, Compressor + Free Cooling, and Free Cooling) based on temperatures and pressures sensed by chiller controls.

.4 All chiller alarms shall be included in chiller controller from manufacturer.

.5 The BMS system shall be capable of displaying chiller status and chiller alarms and setting supply water temperature setpoints.

.12 Energy Recovery Ventilator Sequence, ERV-01:

.1 ERV is enabled and disabled by DDC system and operate based on factory controls. The fan and damper operation shall be controlled by the ERV unit internal control.

.2 DDC system shall switch between Heat Recovery and Free Cooling modes based off of Contractor supplied exhaust air temperature sensor, EA-T, and supply air temperature sensor, DA-T (Set point temperatures to be adjustable).

.3 DDC system shall be capable of indicating current operating status of ERV-01.

.4 Occupied Operation (Heat Recovery, EA-T ≤ 68°F (20°C) **AND/OR** DA-T ≤ 59°F (15°C)):

.1 Supply and exhaust blowers shall be energized.

.2 ERV dampers shall operate in heat recovery operation per internal controls.

.3 The heating coil control valve shall modulate to maintain a supply air temperature of 70°F (21°C) (Set point temperature to be adjustable) measured by supply air temperature sensor, DA-T.

.4 The cooling coil control valve is closed.

.5 Occupied Operation (Free Cooling, EA-T > 68°F (20°C) **AND** 59°F (15°C) < DA-T ≤ 68°F (20°C)):

.1 Supply and exhaust blowers shall be energized.

.2 ERV dampers shall operate in free cooling operation per internal controls.

.3 The heating and cooling coil control valves are closed.

.6 Occupied Operation (Hydronic Cooling, EA-T > 68°F (20°C) **AND** DA-T > 68°F (20°C)):

.1 Supply and exhaust blowers shall be energized.

.2 ERV dampers shall operate in heat recovery operation per internal controls.

.3 The heating coil control valve is closed.

.4 The cooling coil control valve shall modulate to maintain a supply air temperature of 70°F (21°C) (Set point temperature to be adjustable) measured by supply air temperature sensor, DA-T.

.7 Unoccupied Operation:

.1 Supply and exhaust blowers shall be de-energized.

.2 The heating and cooling coil control valves are closed.

.8 BMS shall be capable of displaying ERV status and all alarms from packaged controls.

.9 Alarms

.1 Supply fan failure,

.2 Exhaust fan failure,

.3 Low limit (hard wired),

.4 Smoke detection,

.13 Air Handling Unit, AHU-01:

.1 Air handling unit shall operate continuously to maintain temperature and humidity setpoint within Vault utilizing packaged controls.

.2 BMS shall be capable of indicating current operating status of AHU-01 and all alarms from packaged controls.

.3 Alarms

.1 Process fan failure,

.2 Reactivation fan failure,

.3 Low limit (hard wired),

.4 Smoke detection,

.14 Smudging Exhaust Fan, EF-1

.1 Exhaust fan shall be controlled by Controls Contractor supplied wall timer located within Office 107.

.1 Wall timer shall have selectable time durations in the amount of 20 minutes, 40 minutes and 60 minutes.

.2 BMS shall be capable of indicating current operating status of EF-1.

.15 Condensing Unit, CU-01:

.1 Condensing unit shall be controlled by AHU-01 packaged controls.

.1 Provide all works required to facilitate integration to AHU-01 packaged controls.

.2 BMS shall be capable of indicating current operating status of CU-01 and all alarms from packaged controls.

.16 DHW Recirculation Pump, (RP):

.1 Recirculation Pump shall operate continuously on its own controls.

.2 If Recirculation Pump is not energized, alarm status shall be sent to BMS.

.17 Glycol Fill Stations, GFS-01 & GFS-02:

.1 Glycol fill stations shall operate continuously on their packaged controls.

.2 Low level alarm shall be sent to BMS system.

.18 Carbon Dioxide (CO_2) Monitoring:

.1 BMS system shall be capable of monitoring CO_2 levels throughout building. Install to manufactures' instructions for complete coverage of areas.

.19 Carbon Monoxide Monitoring:

.1 Stand alone gas monitor shall be installed within the Mechanical Room containing gas fired equipment.

.2 CO Detector

.1 Upon sensing CO vapour levels above 12 ppm alarm status shall be sent to BMS system,

.2 Upon sensing CO vapour levels above 25 ppm the alarm shall sound and strobe light shall indicate, alarm status shall be sent to BMS system,

.3 Confirm signal type, re-calibrate with test vapour.

.3 BMS shall be capable of indicating CO Detector alarm status.

3.6 NAMEPLATES

.1 Nameplates shall be provided for all control items listed or shown in the submittal and approved control diagrams.

.2 Each inscription shall identify its function, such as "mixed air controller", "cold deck sensor" in official languages etc. and when applicable, its position.

.1 Size of nameplates shall be 1 inch by 3 inches minimum.
.2 Lettering shall be minimum ¼ inch high normal black lettering.
.3 Submit duplicate samples of identification tags and lists of wording proposed for approval.

3.7 TESTING, COMMISSIONING, & VERIFICATION

.1 Test all field end devices throughout proper input/output ranges.

.2 Testing shall be complete, detailed and documented on approved point-to-point verification forms.

.3 All field calibration must be done with calibrated instrumentation tools suitable for their intended use. Calibration tools shall be calibrated before and after project completion and reports of same submitted to the Project Manager.

.4 Testing and documentation criteria:

.1 Verify that all field devices are properly sized, for anticipated operating range. Devices are adjusted for correction position, orientation and full range.
.2 Conductor Integrity; test continuity of all wiring from field devices to correct input/output.
.3 Conductor Termination; verify that all wiring terminations to devices are per the manufacturer's recommendations.
.4 Conductor to Output; test linear scaling calibration of every analog output point.
.5 Alarm Graphics and interlocking; verify all alarm signals from devices initiation through all required notification components.

.5 Device Calibration; all field devices shall be calibrated, sensor accuracy verified. Calibration shall be done at or close to normal operating conditions.

.1 Calibration Criteria; establish calibration criteria suitable for the intended system function. Suggested HVAC/R calibration criteria;

.1 Space temperature, +/- 0.5 degrees Celsius.
.2 Duct/unit air temperature, +/- 0.5 degrees Celsius.
.3 Fluid temperature, +/- 1 degree Celsius.
.4 Air flow rate, +/- 5%.
.5 Liquid flow rate, +/- 5%.
.6 Differential pressure, +/- 3%.
.7 Static pressure, +/- 3%.
.8 Relative humidity, +/- 2%.

.9 CO monitoring, +/- 3%.

.10 monitoring, +/- 3%.

.11 Refrigerant monitoring, +/- 5%.

.6 Functional Performance Testing:

.1 Comprehensive functional performance testing shall be performed on every system installation. Testing shall include verification of sequences within control software, as well as verification that physical devices respond correctly to the sequences within the software.

.2 The BAS Contractor shall test and document that all logic control sequences have been verified as detailed on the Shop Drawing control sequences. Functional testing shall be documented on forms indicating the date of the testing and personnel performing the testing.

.3 Deficiencies resulting from the functional testing shall be resolved by the BAS Contractor as soon as possible.

.4 System functional testing shall be repeated until successful system test can be documented.

.7 Demonstrations and Training:

.1 Following completion of functional performance testing, demonstration shall commence as follows:

.1 BAS Contractor shall meet the Project Manager and The City on site to review the DDC controls system. The BAS Contractor shall bring a computer with access to the DDC system. The review shall include, but not limited to:

.1 Review of system graphics,

.2 Review of control sequences,

.3 Verifying physical control devices operate as intended.

.2 BAS Contractor shall demonstrate control sequences are correct, and equipment is being controlled to suit the sequence of operations. Temporary system overrides shall be used in the software to simulate all operating scenarios the equipment is expected to operate in. Overrides shall be removed once demonstration is complete.

.2 A separate training session shall be scheduled with The City's operating personnel to provide a tour of the new DDC controls, functions and capabilities. This shall be completed at a location determined by The City.

.8 Performance Verification

.1 The installing Contractor shall perform a complete Performance Verification (PV) of the Building management system three times throughout the project:

.1 At project turnover to customer.

.2 At six (6) months of project operation.

.3 At twelve (12) months of project operation or end of warranty.

.2 Performance Verification shall include a complete and current Building Automation System site inventory including the following information at a minimum: a listing of all field and supervisory controllers with the following key attribute data; corresponding model numbers, firmware versions, available security updates, CPU and memory performance data, battery conditions, integrations, controlled equipment, and device and point counts.

.3 Performance Verification shall include a complete written evaluation of system configuration and performance in the following categories:

.1 Security – The Security evaluation shall include information about controllers that require security updates and conformance of user accounts to latest security rules and best practices.

.2 Energy Performance – The Energy Performance and Savings evaluation shall identify opportunities through schedule and nightly setbacks, economizers, eliminating simultaneous heating and cooling and adding VSD to equipment.

.3 Comfort and Health – The Comfort and Health evaluation shall identify temperature, pressure, and carbon dioxide values that deviate from desired set points that could lead to occupant discomfort.

.4 Reliability – The Reliability evaluation shall identify overridden control points, control points creating excessive alarms, and opportunities to adding control points and trends to further enable system functionality.

.5 Standards – The Standards evaluation shall identify conformance to published standards for point count, network performance and protocol standards.

.4 Provide all reports as specified on a new, USB compatible flash drive

3.8 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 This specification applies to the materials, design, fabrication, inspection, and testing of Input Variable Frequency Drives (VFD) used to control the speed and torque of NEMA design B induction motors.

.1 Motor shall be suitable for the purpose and marked as such as noted in the City of Winnipeg Information Bulletin 2014-013-E/M and in accordance with CSA Part II Standards - No. 100, Motors and Generators, and No. 145, Electric Motors and Generators for Use in Hazardous (Classified) locations.

.2 Mechanical Subcontractor to purchase VFD drives for all pumps as noted and hand over to electrician for installation, coordinate with Electrical Subcontractor and controls Contractor.

.3 Detailed specifications on the VFD shall be indicated in this specification, drawings and attachments. In case of a conflict between the various specifications, the vendor shall contact the Contract Administrator for clarification.

.4 Ensure VFD can handle the motor loads of the equipment actually purchased by the Contractor.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No. 14, Industrial Control Equipment.
.2 CSA C22.2 No. 100, Motors and Generators.
.3 CSA C22.2 No. 145, Electric Motors and Generators for Use in Hazardous (Classified) locations.

.2 The Institute of Electrical and Electronics Engineers (IEEE)

.1 IEEE 519, Recommended Practice and Requirements for Harmonic Control in Electric Power Systems.

.3 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS7, Industrial Control and Systems: Adjustable Frequency Drives.
.2 NEMA MG1, Motors and Generators.
.3 NEMA ICS 7.1—Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems

.4 In all cases where more than one regulation, code, standard or specification applies to the same conditions, the most stringent one shall apply. Conflicts among any of the provisions of these listed codes, standards or specifications shall be referred to the Contract Administrator for resolution.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Drawings shall be in SI units. If imperial units are used as well, they shall be shown in parenthesis after the SI units. In case of conflict between the two, SI units shall be considered to be correct.

.3 Equipment tag number, purchase order number and project name shall be shown on all Supplier supplied drawings. Data shall be located close to the title block.

.4 All drawings and data shall be submitted in a form that is easily reproduced. All data and drawings shall be submitted in both paper and electronic form. Final drawings are all required to be as-built.

.5 Review or approval of Supplier's drawings, design calculations and other documentation does not relieve Supplier of any responsibility for correctness of such drawings, calculations or other documentation.

.6 The following information shall be submitted to the Contract Administrator for approval:

- .1 Master drawing index
- .2 Dimensioned front view elevation
- .3 Dimensioned floor plan
- .4 Dimensioned top view
- .5 Unit control schematics and wiring diagrams
- .6 Nameplate schedule
- .7 Cable entry/exit locations
- .8 Assembly ratings, including short circuit, voltage, and continuous current ratings
- .9 Major component ratings
- .10 Minimum clearances to other equipment.
- .11 Frequency spectrum for harmonic currents at line side of filter (where provided) at 50% and 100% of rated load.
- .12 Compliance to IEEE 519 – harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion (TDD). The VFD manufacturer shall provide calculations specific to the installation, showing total harmonic voltage distortion is less than 5%. Input filters shall be sized and provided as required by the VFD manufacturer to ensure compliance with IEEE electrical system standard 519. All VFDs shall include a minimum of 3% equivalent impedance reactors. VFDs shall include some form of active mitigation.
- .13 Manufacturers technical data sheets

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for motor starters for incorporation into manual specified in Section 21 05 01 General Provisions – Mechanical.

.2 Operation and maintenance manuals shall include as a minimum for each type and style of starter: Instruction books and/or leaflets, recommended renewal parts list and a complete set of as-built drawings.

.3 The following information shall be submitted to Contract Administrator for record purposes:

.1 Final as-built drawings and information
.2 Certified production test reports
.3 Installation information
.4 Seismic certification and equipment anchorage details (where applicable)

Part 2 PRODUCTS

2.1 VARIABLE FREQUENCY DRIVES

.1 Description:

.1 This specification is to cover a complete Variable Frequency Drive (VFD) consisting of a pulse width modulated (PWM) inverter designed for use with both asynchronous and permanent magnet motors.

.2 The drive manufacturer shall supply the drive and all necessary options as specified. All drives installed on this project shall be from the same manufacturer and have a common user interface (control panel). The manufacturer shall have been engaged in the production of this type of equipment for a minimum of 30 years. Drives that are manufactured by a third party and “brand labeled” shall not be acceptable. Drive manufacturers who do not build their own power boards and assemblies, or do not have full control of the power board manufacturing and quality control, shall be considered as a “brand labeled” drive.

.3 This specification is intended to supplement a drive schedule. The drive schedule identifies the optimized BOM for the project and includes quantity, size, voltage, enclosure rating, options, and harmonic mitigation requirements of the drives. IEEE 519-2014 is an electrical system standard for harmonic mitigation and not intended to be applied to an individual piece of equipment. Drives are only one of many sources of harmonics, thus verification of system IEEE 519-2014 compliance is beyond the VFD manufacturer’s scope. The EOR (Contract Administrator of Record) is responsible for conducting an electrical system study and verifying the drive schedule has specified proper harmonic mitigation for the drives.

.2 Quality Assurance:

.1 Drives shall be UL labeled as a complete assembly. The base VFD shall be UL listed for 100 kA SCCR when installed in accordance with the manufacturer’s guidelines.

.2 CE Mark – The base drive shall conform to the European Union Electromagnetic Compatibility directive, a requirement for CE marking. The

base drive shall meet product standard EN 61800-3 for the First Environment restricted distribution (Category C2).

.3 The base drive shall be seismically certified and labeled as such in accordance with the 2018 International Building Code (IBC):

.1 Seismic importance factor of 1.5, and minimum 2.5 SDS rating is required.

.2 Ratings shall be based upon actual shake test data as defined by ICC AC-156, via all three axis of motion.

.3 Seismic certification of equipment and components shall be provided by OSHPD preapproval.

.4 The base drive shall be SEMI-F47 certified. The drive must tolerate voltage sags to 50% for up to 0.2 seconds, sags to 70% for up to 0.5 seconds, and sags to 80% for up to one second.

.3 The drive package as specified herein and defined on the drive schedule shall be enclosed in a UL Type enclosure (enclosures with only NEMA ratings are not acceptable), completely assembled and tested by the manufacturer to ISO9001 standards.

.4 The drive shall provide full rated output from a line of +10% to -15% of nominal voltage. The drive shall continue to operate without faulting from a line of +25% to -35% of nominal voltage.

.1 Drives shall be capable of continuous full load operation under the following environmental operating conditions:

.1 Ambient temperature -15 to 40° C (5 to 104° F).

.2 Altitude 0 to 1000 m (0 to 3,300 ft) above sea level.

.3 Humidity 5 to 95%, non-condensing.

.5 All drives shall utilize the same Advanced Control Panel (keypad) user interface.

.1 Plain English text

.1 The display shall be in complete English words for programming and fault diagnostics (alpha-numeric codes are not acceptable).

.2 Safety interlock and run permissive status shall be displayed using predetermined application specific nomenclature, such as: Damper end switch, smoke alarm, vibration trip, and overpressure.

.3 Safety interlock, run permissive, and external fault status shall have the option of additional customized project specific terms, such as: AHU-1 End Switch, Office Smoke Alarm, CT-2 Vibration.

.2 The control panel shall include at minimum the followings controls:

.1 Four navigation keys (Up, Down, Left, Right) and two soft keys to simplify operation and programming.

.2 Hand-Off-Auto selections and manual speed control without having to navigate to a parameter.

.3 Fault Reset and Help keys. The Help key shall include assistance for programming and troubleshooting.

.3 Multiple Home View screens shall be capable of displaying up to 21 points of information. Customizable modules shall include bar charts, graphs, meters, and data lists. Displays shall provide real time graphical trending of output power, frequency, and current within selectable intervals of 15/30/60 minutes and 24 hours.

.4 The control panel shall display the following items on a single screen; output frequency, output current, reference signal, drive name, time, and operating mode (Hand vs Auto, Run vs Stop). Bi-color (red/green) status LED shall be included. Drive (equipment) name shall be customizable.

.5 There shall be a built-in time clock in the control panel. The clock shall have a battery backup with 10 years minimum life span. Daylight savings time shall be selectable.

.6 I/O Summary display with a single screen shall indicate and provide:

.1 The status/values of all analog inputs, analog outputs, digital inputs, and relay outputs. Drives that require access to internal or live components to measure these values, are not acceptable.

.2 The programmed function of all analog inputs, analog outputs, digital inputs, and relay outputs.

.3 The ability to force individual digital I/O high or low and individual analog I/O to desired value, for increased personal protection during drive commissioning and troubleshooting. Drives that require access to internal or live components to perform these functions, are not acceptable.

.7 The drive shall automatically backup parameters to the control panel. In addition to the automatic backup, the drive shall allow two additional unique backup parameter sets to be stored. Backup files shall include a time and date stamp. In the event of a drive failure, the control panel of the original drive can be installed on the replacement drive, and parameters from that control panel can be downloaded into the replacement drive.

.8 The control panel shall display local technical support contact information as part of drive fault status.

.9 The control panel shall be removable, capable of remote mounting.

.10 The control panel shall have the ability to store screen shots, which are downloadable via USB.

.11 The control panel shall have the ability to display a QR code for quick access to drive information.

.12 The LCD screen shall be backlit with the ability to adjust the screen brightness and contrast, with inverted contrast mode. A user-selectable timer shall dim the display and save power when not in use.

.13 The control panel shall include assistants specifically designed to facilitate start-up. Assistants shall include: First Start Assistant, Basic Operation, Basic Control, and PID Assistant.

.14 Primary settings for HVAC shall provide quick set-up of all parameters and customer interfaces to reduce programming time.

.15 The drive shall be able to operate with the control panel removed.

.16 The drive shall be able to support a Bluetooth Advanced Control Panel. The Bluetooth control panel shall be FCC and QDL (Qualified Design Listing) certified.

.1 A free app (iOS and Android) shall replicate the control panel on a mobile device or tablet. The control panel's programming and control functionality shall function on the device. Customizing text, such as AHU-1 End Switch, shall be supported by the device's keyboard.

.2 Bluetooth connectivity shall allow uploading, downloading, and emailing of parameter sets.

.3 Bluetooth connectivity shall include two pairing modes: Always discoverable with a fixed passcode, and manual discovery with a unique generated passcode every pairing.

.4 The Bluetooth antenna shall be in the control panel. Antennas that are integrated in the drive's control board, must include an external antenna, on all drives mounted inside cabinets.

.5 Bluetooth connectivity shall be capable of being switched off.

.6 All drives shall have the following hardware features/characteristics as standard:

.1 Two (2) programmable analog inputs shall accept current or voltage signals. Current or Voltage selection configured via control panel. Drives that require access to internal components to perform these functions, are not acceptable.

.2 Two (2) programmable analog outputs. At least one of the analog outputs shall be adjustable for current or voltage signal, configured via control panel. Drives that require access to internal components to perform these functions, are not acceptable.

.3 Six (6) programmable digital inputs. All digital inputs shall be programmable to support both active high and active low logic, and shall include adjustable on/off time delays. The digital input shall be capable of accepting both 24 VDC and 24 VAC.

.4 Three (3) programmable Form-C relay outputs. The relay outputs shall include programmable on/off time delays. The relays shall be rated for a continuous current rating of 2 Amps. Maximum switching voltage of 250 VAC / 30 VDC. Open collector and Form-A relays are not acceptable. Drives that have less than (3) Form-C relay outputs shall provide an option card to provide additional relay outputs.

.5 Drive terminal blocks shall be color coded for easy identification of function.

.6 The drive shall include an isolated USB port for interface between the drive and a laptop. A non-isolated USB port is not acceptable.

.7 An auxiliary power supply rated at 24 VDC, 250 mA shall be included.

.8 At a minimum, the drives shall have internal impedance equivalent to 5% to reduce the harmonics to the power line. 5% impedance may be from dual (positive and negative DC link) chokes, or AC line reactor. Drives with only one DC link choke shall add an AC line choke integral to the drive enclosure. Reference the drive schedule to determine if additional harmonic mitigation is required for the system to comply with IEEE 519-2014.

.9 The drive shall have cooling fans that are designed for field replacement. The primary cooling fan shall operate only when required and be variable speed for increased longevity and lower noise levels. Drives whose primary cooling fans are not variable speed, shall include a spare cooling fan.

.10 The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds every minute. The minimum current rating shall meet or exceed the values in the NEC/UL table 430.250 for 4-pole motors.

.11 The input current rating of the drive shall not be greater than the output current rating. Per NFPA 70 430.122, drives with higher input current ratings may require the upstream wiring, protection devices, and source transformers to be upsized.

.12 Circuit boards shall be coated per IEC 60721-3-3; Chemical gasses Class 3C2 and Solid particles Class 3S2.

.13 Earth (ground) fault detection shall function in both modulating (running) and non-modulating modes.

.14 Coordinated AC transient surge protection system consisting of 4 MOVs (phase-to-phase and phase-to-ground), a capacitor clamp, and internal chokes. The MOVs shall comply with UL 1449 4th Edition. Drives that do not include coordinated AC transient surge protection shall include an external TVSS/SPD (Transient Voltage Surge Suppressor/Surge Protection Device).

.15 The drive shall include a robust DC bus to provide short term power-loss ride through. The DC bus Joule to drive kVA ratio shall be 4.5 J/kVA or higher. An inertia-based ride through function should help maintain the DC bus voltage during power loss events. Drives with control power ride through only, are not acceptable.

.7 All drives shall have the following software features as standard:

.1 A Fault Logger that stores the last 16 faults in non-volatile memory.

.1 The most recent 5 faults save at least 9 data points, including but not limited to: Time/date, frequency, DC bus voltage, motor current, DI status, temperature, and status words.

.2 The date and time of each fault and fault reset attempt shall be stored in the Fault Logger.

.2 An Event Logger that stores the last 16 warnings or events that occurred, in non-volatile memory.

.1 Events shall include, but not limited to: Warning messages, checksum mismatch, run permissive open, start interlock open, and automatic reset of a fault.

.2 The date and time of each event's start and completion points shall be stored in the Event Logger.

.3 Programmable start method. Start method shall be selectable based on the application: Flying-start, Normal-start, and Brake-on-start.

.4 Programmable loss-of-load (broken belt / coupling) indication. Indication shall be selectable as a control panel warning, relay output, or over network communications. This function to include a programmable time delay to eliminate false loss-of-load indications.

.5 Motor heating function to prevent condensation build up in the motor. Motor heating adjustment, via parameter, shall be in "Watts." Heating functions based only on "percent current" are not acceptable.

.6 Advanced power metering abilities shall be included in the drive. Drives without these data points, must include a separate power meter with each drive.

.1 Instantaneous output power (kW)

.2 Total power, broken down by kWh, MWh, and GWh units of measurement. Power meters that only display kWh and roll over or "max out" once the maximum kWh value is reached, are not acceptable. There shall be resettable and non-resettable total power meters within the drive.

.3 Time based kWh metering for: current hour, previous hour, current day, and previous day.

.4 Energy saving calculation shall be included that shows the energy and dollars saved by the drive.

.7 The drive shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and reduce audible motor noise.

.8 Run permissive circuit - There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command, the Drives shall provide a dry contact closure that will signal the damper to open. When the damper is fully open, an end-switch shall close, allowing the drive to run the motor.

.1 The drive shall also include a programmable start delay, for when an end-switch is not provided.

.9 Start interlock circuit - Four separate start interlock (safety) inputs shall be provided. When any safety is opened, the motor shall be commanded to stop. The control panel will display the specific safety(s) that are open. The status of each safety shall be transmitted over the network communications. Wiring multiple safeties in series is not acceptable.

.10 External fault circuit – Three separate external fault inputs shall be provided. This circuit shall have the same features and functionality as the start

interlock circuit, except it shall require a manual reset before the drive is allowed to operate the motor.

.11 The drive shall include a switching frequency control circuit that reduces the switching frequency based on actual drive temperature, and allows higher switching frequency settings without derating the drive. It shall be possible to set a minimum and a target switching frequency.

.12 Visual function block adaptive programming allowing custom control schemes, minimizing the need for external controllers. I.e. cooling tower staging logic. A free software tool shall be used to configure adaptive programming.

.13 The ability to automatically restart after an over-current, over-voltage, under-voltage, external fault, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable. Each of these faults may have automatic restart individually disabled via a parameter selection.

.14 Three (3) programmable critical frequency lockout ranges to prevent the drive from operating the load continuously at an unstable speed/load.

.15 Seven (7) programmable preset frequencies/speeds.

.16 Two independently adjustable accel and decel ramps with 1 – 1800 seconds adjustable time ramps.

.17 PID functionality shall be included in the drive.

.1 Programmable “Sleep” and “Wake up” functions to allow the drive to be started and stopped based on the level of a process feedback signal.

.2 The drive shall include an independent PID loop for customer use, assigned to an Analog Output. This PID loop may be used for cooling tower bypass valve control, chilled water valve, etc.

.18 At least 4 parameter user sets that can be saved to the permanent memory and recalled using a digital input, timed function, or supervision function.

.19 Drive shall be compatible with an accessory that allows the control board to be powered from an external 24 VDC/VAC source, allowing the drive control to remain powered by a UPS during an extended power outage.

.20 A computer-based software tool shall be available to allow a laptop to program the drive. The drive shall be able to support programming without the need for line voltage. All necessary power shall be sourced via the laptop USB port.

.21 The drive shall include a fireman’s override mode. Upon receipt of a contact closure from the Fire Alarm Life Safety system, the drive shall operate in a dedicated Override mode distinct and separate from the drive’s Normal operation mode. The following features will be available in the drive override function:

.1 The Override mode shall be secured by password to prevent changes once programmed.

.2 The drive shall ignore external inputs and commands not defined as part of the override function.

.3 Override operation mode shall be selectable between: single frequency, multiple fixed frequencies, follow an analog input signal, PID control, or come to a forced stop.

.4 High priority safeties shall stop the drive and lower priority safeties shall be ignored in Override mode.

.5 Drive faults shall be defined in Critical and Low priority groups. Critical faults shall stop the drive. Low priority faults shall be reset. Reset trials and timing shall be programmable.

.6 The drive shall be configurable to receive from 1 to 3 discrete digital input signals and operate at up to three discrete speeds.

.22 The drive shall have multi-pump functionality and an intelligent master/follower configuration for controlling up to 8 parallel pumps equipped with drives. The drive shall have a parameter synchronization feature to program the PID, multi-pump, and AI parameters in all parallel drives. The functionality to start and stop the pumps based on capacity, operating time or efficiency of the pump to ensure each pump is operated regularly.

.1 The multi-pump functionality shall control:

.1 Flow Control

.2 Pressure Control

.3 Pump Alternation

.8 Security Features:

.1 The drive manufacture shall clearly define cybersecurity capabilities for their products.

.2 The drive shall include password protection against parameter changes.

.1 There shall be multiple levels of password protection including: End User, Service, Advanced, and Override.

.2 The drive shall support a customer generated unique password between 0 and 99,999,999.

.3 The drive shall log an event whenever the drive password has been entered.

.4 The drive shall provide a security selection that prevents any “back door” entry. This selection even prevents the drive manufacturer from being able to bypass the security of that drive.

.5 A security level shall be available that prevents the drive from being flashed with new firmware.

.3 A checksum feature shall be used to notify The City of unauthorized parameter changes made to the drive. The checksum feature includes two unique values assigned to a specific programming configuration.

.1 One checksum value shall represent all user editable parameters in the drive except communication setup parameters. A second

checksum value shall represent all user editable parameters except communication setup, energy, and motor data parameters.

.2 Once the drive has been commissioned the two values can be independently saved in the drive.

.3 The drive shall be configurable to either: Log an Event, provide a Warning, or Fault upon a parameter change when the current checksum value does not equal the saved checksum value.

.4 The "Hand" and "Off" control panel buttons shall have the option to be individually disabled (via parameter) for drives mounted in public areas.

.5 The capability to disable Bluetooth on control panels that include Bluetooth functionality shall be provided.

.9 Network Communications

.1 The drive shall have an EIA-485 port with removable terminal blocks. The onboard protocols shall be BACnet MS/TP, Modbus, and Johnson Controls N2. Optional communication cards for BACnet/IP, LonWorks, Profibus, Profinet, EtherNet/IP, Modbus TCP, and DeviceNet shall be available. The use of third party gateways are not acceptable.

.2 The drive shall have the ability to communicate via two protocols at the same time, one onboard protocol and one option card based protocol. Once installed, the drive shall automatically recognize any optional communication cards without the need for additional programming.

.3 The drive shall not require a power cycle after communication parameters have been updated.

.4 The embedded BACnet connection shall be a MS/TP interface. The drive shall be BTL Listed to Revision 14 or later. Use of non-BTL Listed drives are not acceptable.

.5 The drive shall be classified as an Applications Specific Controller (B-ASC). The interface shall support all BIBBs defined by the BACnet standard profile for a B-ASC including, but not limited to:

.1 Data Sharing: Read Property Multiple-B, Write Property Multiple-B, COV-B

.2 Device Management: Time Synchronization-B

.3 Object Type Support: MSV, Loop

.6 The drive's relay output status, digital input status, analog input/output values, Hand-Auto status, warning and fault information shall be capable of being monitored over the network. The drive's start/stop command, speed reference command, relay outputs and analog outputs shall be capable of being controlled over the network. Remote drive fault reset shall be possible.

.10 Options

.1 Disconnect – A circuit breaker or disconnect switch shall be provided when indicated on the drive schedule. The disconnect shall be door interlocked and padlockable. Drive input fusing shall be included on all packaged units

that include a disconnecting means. All disconnect configurations shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label. Disconnect packages manufactured by anyone other than the drive manufacturer, are not acceptable.

.2 Bypass – Bypass drive packages shall be provided when indicated on the drive schedule. All drive/bypass configurations shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label. Bypasses manufactured by anyone other than the drive manufacturer, are not acceptable.

.1 The drive and bypass package shall be a complete factory wired and tested bypass system consisting of a padlockable disconnect device, drive output contactor, bypass contactor, and drive input fuses.

.2 The drive and bypass package shall have a UL listed short circuit current rating of 100 kA, for 240 VAC and 480 VAC systems, and this rating shall be indicated on the rating label.

.3 The bypass control shall be powered by a three-phase switch mode power supply with a voltage tolerance of +30%, -35%. Single-phase power supplies and control power transformers (CPT) are not acceptable.

.4 The drive and bypass package shall be seismic certified and labeled to the IBC. Seismic importance factor of 1.5 rating is required, and shall be based upon actual shake table test data as defined by ICC AC-156. Seismic certification of equipment and components shall be provided by OSHPD preapproval.

.5 All bypass packages shall utilize a dedicated LCD bypass control panel (keypad) user interface. The bypass control panel must be a separate display from the drive control panel. Bypass packages that use a single shared drive/bypass control panel are not acceptable, due to that control panel acting as a single point of failure.

.1 The bypass shall include a two-line, 20-character LCD display. The display shall allow the user to access parameters and view:

.1 Bypass input voltage, current (Amps) and power (kW)

.2 Bypass faults, warnings, and fault logs

.3 Bypass operating time and energy consumption (resettable)

.2 The bypass control panel shall include the following controls:

.1 Four navigation keys (Up, Down, Enter, Escape)

.2 Bypass Hand-Off-Auto, Drive mode / Bypass mode selectors, Bypass fault reset

.3 The following indicating lights (LED PTT type) or control panel display indications shall be provided.

.1 Drive mode selected, Bypass mode selected

.2 Drive running, Bypass running

.3 Drive fault, Bypass fault

.4 Safety interlock and run permissive status shall be displayed using predetermined application specific nomenclature, such as: Damper end switch, smoke alarm, vibration trip, and overpressure.

.6 All bypasses shall have the following hardware features/characteristics as standard:

.1 Six (6) digital inputs and five (5) Form-C relay outputs. The digital inputs shall be capable of accepting both 24 VDC and 24 VAC. The bypass control board shall include an auxiliary power supply rated 24 VDC, 250 mA.

.2 Drive isolation fuses shall be provided. Bypass designs which have no such fuses, or that only incorporate fuses common to both the drive and the bypass are not acceptable. Third contactor “isolation contactors” and service switches are not an acceptable alternative to drive isolation fuses.

.3 The bypass shall be able to detect a single-phase input power condition while running in bypass, disengage the motor, and provide a single-phase input power indication.

.4 The bypass shall be designed for stand-alone operation and be completely functional in both Hand and Automatic modes, even if the drive and/or drive’s control board has failed. Network communications shall remain functional. Bypass systems that do not maintain full functionality in the event of a drive failure, are not acceptable.

.7 All bypasses shall have the following software features as standard:

.1 Programmable loss-of-load (broken belt / coupling) indication shall be functional in drive and bypass mode.

.2 The bypass shall also support run permissive and start interlock control functionality, including start delay, as previously specified in the drive section.

.3 The bypass control shall monitor the status of the drive and bypass contactors and indicate when there is a welded contactor contact or open contactor coil.

.4 The bypass shall include a selection for either manual or automatic transfer to bypass. The automatic transfer mode shall allow the user to select the specific drive fault types that result in an automatic transfer to bypass. The automatic

transfer mode shall not allow a transfer to bypass on motor related faults. Automatic transfer schemes that do not differentiate between fault types, are not acceptable.

.5 The bypass shall include the ability to select the operating mode of the system (Drive/Bypass) from either the bypass control panel or digital input.

.6 The bypass shall include a supervisory control mode that monitors the value of the drive's analog input (feedback). This feedback value is used to control the bypass contactor on/off state. The supervisory mode shall allow the user to maintain hysteresis control over applications such as cooling towers and booster pumps.

.7 Selectable Class 10, 20, or 30 electronic motor overload protection shall be included in both drive and bypass mode.

.8 The drive and bypass shall be designed to operate as an integrated system when in Override mode. Whether operating in drive or bypass mode, the low priority safeties will be ignored, and high priority safeties will be followed. External start/stop commands will be ignored. There shall be four selectable Override modes:

.1 Bypass only, with two smoke control modes:

.1 Fixed pre-configuration of digital inputs

.2 Configurable high/low priority safeties and faults, to allow configuration to meet needs of local Authority Having Jurisdiction.

.2 Drive only

.3 Drive then transfer to bypass, in the event of a drive fault

.4 Force to Stop

.8 Network communications – the bypass shall include BACnet MS/TP, Modbus, and Johnson Controls N2 as standard. The bypass BACnet implementation shall be BTL Listed to Revision 14 or later. Optional communication cards for BACnet/IP, LonWorks, Profibus, Profinet, Ethernet/IP, Modbus TCP, and DeviceNet shall be available.

.1 The bypass relay output status, digital input status, warning and fault information can be monitored over the network. Status information shall be monitored, including; operating mode (drive vs bypass), current drawn in bypass mode, broken belt, and phase-to-phase voltage. The bypass start/stop command, force to bypass command, and relay outputs shall be capable of being controlled over the network.

.11 Acceptable Product: ABB ACH580 Series VFD c/w TCI HG7 Harmonic Filter or Approved Equal in accordance with frontend clause B6.

Part 3 EXECUTION

3.1 INSTALLATION

.1 In accordance with Division 26.

3.2 START-UP

.1 Retain factory trained representative for setup and commissioning of VFD. Provide written report to Contract Administrator.

.2 Retain factory trained representative to provide one day of training for The City personnel

.3 Confirm power lugs and VFD can accommodate the pump motor cables leads.

.4 Commission VFD so that equipment is controlled as per Section 23 09 33 Electric & Electronic Control Systems for HVAC.

3.3 WARRANTY

.1 Warranty shall be 30 months from the date of shipment from the factory or 12 months after installation, whichever is longer. The warranty shall include: Parts, on-site labor, and travel time and travel costs, or replacement of the complete drive as determined by the drive manufacturer's technical support.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes materials and installation for piping, valves and fittings for gas fired equipment.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B16.5, Pipe Flanges and Flanged Fittings.
.2 ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
.3 ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
.4 ASME B18.2.1, Square and Hex Bolts and Screws Inch Series.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM A 47/ A 47M, Standard Specification for Ferritic Malleable Iron Castings.
.2 ASTM A 53/A 53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
.3 ASTM B 75M, Standard Specification for Seamless Copper Tube.
.4 ASTM B 837, Standard Specification for Seamless Copper Tube for Natural Gas and Liquefied Petroleum (LP) Gas Fuel Distribution Systems.

.3 Canadian Standards Association (CSA International)

.1 CSA W47.1, Certification of Companies for Fusion Welding of Steel.

.4 Canadian Standards Association (CSA)/Canadian Gas Association (CGA)

.1 CAN/CSA B149.1HB, Natural Gas and Propane Installation Code Handbook.
.2 CAN/CSA B149.2, Propane Storage and handling Code.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.
.2 Indicate on manufacturer's catalogue literature the following: valves.

.2 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.3 Certificates: submit signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Instructions: submit manufacturer's installation instructions.

.5 Closeout Submittals: submit maintenance and engineering data for incorporation into manual specified in 21 05 01 General Provisions – Mechanical.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

Part 2 PRODUCTS

2.1 PIPE

.1 Steel pipe: to ASTM A53 Grade B, or ASTM A106, Schedule 40, seamless as follows:

.1 NPS ½ to NPS 2, screwed.
.2 NPS 2 ½ and over, plain end.

2.2 JOINTING MATERIAL

.1 Screwed fittings: Loctite 565 pipe thread sealant and Masters pipe joint tape.

.2 Welded fittings: to CSA W47.1.

.3 Flange gaskets: non-metallic flat.

2.3 FITTINGS

.1 Steel pipe fittings, screwed, flanged or welded:

.1 Malleable iron:

.1 Screwed, banded, to ASTM A197/A197M, manufactured to ASME B16.3, B16.14, NPT threads to ASME B1.20.1, Class 150.

.2 Steel Pipe flanges and flanged fittings:

.1 To ASTM A105, manufactured to ASME B16.5, Class 150.

.3 Welding:

.1 Butt-welded fittings to ASTM A234 WPB, manufactured to ANSI B16.9.

.4 Unions:

.1 Malleable iron to ASTM A47M, manufactured to ANSI B16.39, NPT threads to B1.20.1, Class 150.

.5 Bolts and Nuts:

.1 to ANSI B18.2.1.

.6 Nipples:

.1 Schedule 80, threaded carbon steel to ASTM A106, Grade B, Plain End. Manufactured to ANSI B36.10

2.4 ISOLATION VALVES

.1 Provincial Code approved ball type.

2.5 PRESSURE REGULATING VALVES

.1 Provincial Code approved for service regulator duty; sized to suit appliance application.

.2 Regulators complete with all nameplate identification of performance and code compliance ratings as required by authority having jurisdiction.

.3 Ventless regulators not permitted.

.4 Approved Manufacturer: Fisher or Approved Equal in accordance with frontend clause B6.

Part 3 EXECUTION

3.1 PIPING

.1 Install in accordance with Section 23 05 05 Installation of Pipework, CAN/CSA B149.1, supplemented as specified.

.2 Contractor shall not use any existing thin wall pipe found on site.

.3 Natural gas piping shall be reamed out and threaded to accommodate hand tightening a fitting 3 to 4 turns. Apply natural gas approved Teflon tape opposite thread, 3 complete wraps and apply natural gas pipe dope as specified.

.4 Piping exposed to elements shall be painted with metal primer, and given at least one coat of exterior enamel paint.

.5 Expansion loops shall be used in accordance with CAN/CSA B149.1.

.6 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.

.7 Slope piping down in direction of flow to low points.

.8 Install drip points:

.1 At low points in piping system.
.2 At each connection to equipment.

.9 Use eccentric reducers at pipe size change installed to provide positive drainage.

3.2 VENTS

.1 Install vents from regulators and control valves, terminate outside building in approved location, protected against blockage, damage.

3.3 VALVES

.1 Install valves with stems upright or horizontal unless otherwise approved by Contract Administrator.

.2 Install valves at branch take-offs to isolate pieces of equipment, and as indicated.

3.4 FIELD QUALITY CONTROL

.1 Pressure Testing: Refer to Section 21 05 01 General Provisions – Mechanical.

.2 Purging: purge after pressure test in accordance with CAN/CSA B149.1.

.3 Pre-Start-Up Inspections:

.1 Check vents from regulators, control valves, terminate outside building in approved location, protected against blockage, damage.

.2 Check gas trains, entire installation is approved by authority having jurisdiction.

3.5 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

.1 American National Standards Institute/American Water Works Association (ANSI/AWWA)

.1 ANSI/AWWA C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.2 American Society of Mechanical Engineers (ASME)

.1 ASME B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
.2 ASME B16.3, Malleable Iron Threaded Fittings: Classes 150 and 300.
.3 ASME B16.5, Pipe Flanges and Flanged Fittings: NPS ½ through NPS 24 Metric/ Inch Standard.
.4 ASME B16.9, Factory-Made Wrought Buttwelding Fittings.
.5 ASME B16.21, Nonmetallic Flat Gaskets for Pipe Flanges
.6 ASME B18.2.1, Square Hex, Heavy Hex and Askew Head Bolts and Hex, Heavy Hex, Hex Flange. Lobed Head and Lag Screws (Inch Series).
.7 ASME B18.2.2, Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series).

.3 American Society of Mechanical Engineers (ASME) / American National Standards Institute (ANSI)

.1 ASME/ANSI B31.9 Building Services Piping.

.4 ASTM International

.1 ASTM A 47/A 47M, Standard Specification for Ferritic Malleable Iron Castings.
.2 ASTM A 53/A 53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
.3 ASTM A 536, Standard Specification for Ductile Iron Castings.
.4 ASTM B 61, Standard Specification for Steam or Valve Bronze Castings.
.5 ASTM B 62, Standard Specification for Composition Bronze or Ounce Metal Castings.
.6 ASTM E 202, Standard Test Method for Analysis of Ethylene Glycols and Propylene Glycols.

.5 CSA International

.1 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.
.2 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.

.6 Manufacturer's Standardization of the Valve and Fittings Industry (MSS)

.1 MSS-SP-67, Butterfly Valves.
.2 MSS-SP-70, Gray Iron Gate Valves, Flanged and Threaded Ends.

.3 MSS-SP-71, Gray Iron Swing Check Valves Flanged and Threaded Ends.
.4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.
.5 MSS-SP-85, Gray Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit shop drawings and product data in accordance with Sections 21 05 01 General Provisions – Mechanical.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for hydronic systems, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Components and accessories
.2 Equipment
.3 Valves
.4 Accessories

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Operation and Maintenance Data: submit operation and maintenance data for hydronic systems for incorporation into manual.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with manufacturer's written instructions.

Part 2 PRODUCTS

2.1 DESIGN & SERVICE CONDITIONS

.1	Design Pressure:	to 150 psig,
.2	Design Temperature:	32°F to 225°F,
.3	Mechanical Connections - Pressure Class:	Class 150
.4	Corrosion Allowance:	0.125 – in.
.5	Applicable Design Code:	B31.9 Building Services Piping

.6 Actual Service Conditions:

.1 Chilled Water:

.1 Pressure: 80 psig
.2 Temperature Range: 50 to 60.8°F

.2 Cooling Water:
.1 Pressure: 80 psig
.2 Temperature Range: 77 to 91.6°F

.3 Glycol:
.1 Pressure: 60 psig
.2 Temperature Range: 44 to 54°F

2.2 PIPE

.1 NPS ½ – 26: Schedule 40 carbon steel to ASTM A53, Grade B Seamless or ASTM A106, Grade B. Manufactured to ASME B36.10.

2.3 PIPE JOINTS (NON-GROOVED)

.1 NPS 2 & less: Screwed fittings with Teflon tape.

.2 NPS 2-1/2 & up: Welded fittings and flanges to CSA W47.1 and CSA W47.1S1.

.3 Flanges: Plain or raised face, slip-on or weld neck

.4 Flange Gaskets:

.1 Thickness:
.1 1/2 to 6 in: 1/16 in
.2 8 to 24 in: 1/8 in

.2 Compressed synthetic fibres, non-asbestos, NBR binder, anti-stick releasing agents both sides, ANSI B16.21 self-centering flat ring. Maximum pressure 1500 psig. Identifiable under ASTM F104. Durabla Durlon 8500 Green or Approved Equal in accordance with frontend clause B6.

.5 Bolts and Nuts: to ANSI B18.2.1 and B18.2.2

2.4 PIPE JOINTS (GROOVED)

.1 <u>Grooved piping shall not be installed within Mechanical Room.</u>

.2 NPS 1/2 & up: Pipe ends to be grooved in accordance with Victaulic current listed standards conforming to ANSI/AWWA C-606

.3 Grooving Tools

.1 Grooving tools shall be of the same manufacturer as the grooved components.

.2 Grooved end product manufacturer to be ISO-9001 certified. Grooved couplings shall meet the requirements of ASTM F-1476

.4 Flanges: plain or raised face, slip-on or weld neck

.5 Grooved Couplings:

.1 Housing: Ductile iron conforming to ASTM A536, Grade 65-45-12

.2 Gasket: Grade "E" EPDM

.3 Bolts: Carbon steel oval neck track bolts to ASTM A449 and zinc electroplated to ASTM B633 ZN/FE5, finish Type III.

.4 Nuts: Carbon steel hex nut to ASTM A563 Grade B and zinc electroplated to ASTM B633 ZN/FE5, finish Type III.

.5 Acceptable Product: Victaulic Flexible Coupling, Style 77.

.6 Flange Gaskets:

.1 Thickness:

.1 1/2 to 6 in: 1/16 in

.2 8 to 24 in: 1/8 in

.2 Compressed synthetic fibres, non-asbestos, NBR binder, anti-stick releasing agents both sides, ANSI B16.21 self-centering flat ring. Maximum pressure 1500 psig. Identifiable under ASTM F104. Durabla Durlon 8500 Green or Approved Equal in accordance with frontend clause B6.

.7 Bolts and Nuts: to ANSI B18.2.1 and B18.2.2

2.5 FITTINGS

.1 Screwed Fittings:

.1 Malleable iron: to ASTM A197/A197M and ANSI/ASME B16.3, class 150.

.2 Flanges:

.1 Forged steel to ASTM A105 and ANSI/ASME B16.5, class 150, R.F.

.3 Butt-weld Fittings:

.1 Carbon steel to ASTM A234 and ANSI/ASME B16.9 grade WPB.

.4 Grooved Fittings:

.1 Malleable iron: to ASTM A197/A197M.

.2 Carbon steel to ASTM A234.

.5 Unions:

.1 Malleable iron: to ASTM A47M and ANSI/ASME B16.3, class 150.

2.6 FLEXIBLE PIPE CONNECTORS

.1 Provide Class 150 and Class 300 flanged, stainless steel braided flexible connectors in the sizes indicated;

.2 Accessories: provide Class 150 or 300 slip-on flanges as dictated by Material Specification.

.3 Acceptable product: Senior Flexonics Model BSFS, Flex Hose or Approved Equal in accordance with frontend clause B6.

2.7 BALL VALVES

.1 NPS 2 & under, screwed:

.1 600 pound.
.2 brass body, chrome plated ball, Teflon seat, steel lever handle, with threaded ends
.3 Acceptable Product: M. A. Stewart B series model B-1F or Approved Equal in accordance with frontend clause B6.

2.8 BUTTERFLY VALVES

.1 Lugged Cast Iron Body: to ASTM A-126, Class B

.2 Ductile Iron/Nickle Plated Disc: to ASTM A-536 GR 65/45/12

.3 Stainless Steel Stem: to ASTM A-276

.4 EPDM Seat, Teflon Gar-Fil Bearing, Carbon Steel Pin

.5 Approved Product: Keystone Series 60 or Approved Equal in accordance with frontend clause B6.

2.9 GLOBE VALVE

.1 NPS 2 and under, screwed:

.1 Rising stem: to MSS SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc.
.2 Lockshield handles: as indicated.

2.10 CHECK VALVES

.1 NPS 2 and under, screwed:

.1 Swing check: to MSS SP-80, Y-pattern, screwed cap, swivel type metal disc, threaded ends, brass body, class 150.

2.11 STRAINERS

.1 Cast iron body and end cap, stainless steel insert screen, threaded connections.

.2 Maximum working pressure 860 kPa, maximum working temperature 121°C.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 PIPING INSTALLATION

.1 Install pipework in accordance with Section 23 05 05 Installation of Pipework, supplemented as specified.

.2 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.

.3 Ream pipes, clean scale and dirt, inside and outside, before and after assembly.

3.3 VALVES

.1 Install valves with stems upright or horizontal unless approved otherwise by Contract Administrator.

.2 Install ball or butterfly valves at all branches take-offs and to isolate each piece of equipment, as indicated

.3 Install swing check valves on discharge of pumps and as indicated.

.4 Install chain operators on valves NPS 2 1/2 and over where installed more than 2400 mm above floor in Boiler Rooms.

3.4 STRAINERS

.1 Install in horizontal or downflow lines.

.2 Ensure clearance for removal of basket.

.3 Install ahead of each pump.

3.5 CLEANING, FLUSHING & STARTUP

.1 Refer to Section 23 08 02 Flushing, Cleaning and Start-up of Mechanical Piping Systems.

3.6 TESTING

.1 Test system in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Repair any leaking joints, fittings or valves.

.3 Verify safety valve operation.

3.7 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by hydronic systems installation.

3.8 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME Boiler and Pressure Vessel Code.

.2 ASTM International Inc.

.1 ASTM A47/A47M, Standard Specification for Ferritic Malleable Iron Castings.
.2 ASTM A278/A278M, Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650 degrees F (350 degrees C).
.3 ASTM A516/A516M, Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower - Temperature Service.
.4 ASTM A 536, Standard Specification for Ductile Iron Castings.
.5 ASTM B 62, Standard Specification for Composition Bronze or Ounce Metal Castings.

.3 Canadian Standards Association (CSA International)

.1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.
.2 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code, Supplement #1.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for expansion tanks, air vents, separators, valves, and strainers and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit shop drawings in accordance with Section 21 05 01 General Provisions – Mechanical.

1.3 CLOSEOUT SUBMITTALS

.1 Submit maintenance and operation data in accordance with Section 21 05 01.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 PRODUCTS

2.1 HYDRONIC EXPANSION TANK, ET

.1 The pressurization system shall include a replaceable bladder-type expansion tank which will accommodate the expanded water of the system generated within the normal operating temperature range, limiting this pressure increase at those components in the system to the maximum allowable pressure at those components. It shall maintain minimum operating pressure necessary to eliminate all air. The only air in the system shall be the permanent sealed-in air cushion contained in the replaceable bladder-type tank. Dimensions shall be as indicated on the drawings and schedule.

.2 The expansion tank shall be welded steel, constructed, tested and stamped in accordance with Section VIII, Division 1 of the ASME Code for a working pressure of 125 PSIG and air pre-charged.

.3 The tank shall be supported by steel legs or a base (integral ring mount) for a vertical installation. Each tank will have a heavy-duty replaceable butyl bladder.

.4 The manufacturer shall have at least five years experience in the fabrication of bladder-type ASME expansion tanks.

.5 Performance:

Tag	ET-01	ET-02	ET-03
Description	Hydronic Heating Expansion Tank	Glycol Heating Expansion Tank	Chilled Water Expansion Tank
Location	Mech. Room	Mech. Room	Mech. Room
Type	Bladder	Bladder	Bladder
Fluid Type	Water	Glycol/Water	Glycol/Water
Tank Volume, usgal	80	53	53
Acceptance Volume, usgal	52	34.5	34.5
Make/Model	Amtrol Extrol 300-L	Amtrol Extrol 200-L	Amtrol Extrol 200-L

.6 Approved Product:

.1 Amtrol Extrol series or Approved Equal in accordance with frontend clause B6.

2.2 BUFFER TANK

.1 The buffer tank which will provide additional system volume. An internal baffle will ensure that fluid within the tank is circulated. Dimensions shall be as indicated on the drawings and schedule.

.2 The buffer tank shall be welded steel, constructed, tested and stamped in accordance with Section VIII, Division 1 of the ASME Code for a working pressure of 125 PSIG.

.3 The tank shall be supported by steel legs or a base (integral ring mount) for a vertical installation.

.4 The manufacturer shall have at least five years experience in the fabrication of ASME buffer tanks.

Tag	BT-01
Description	Chilled Water Buffer Tank
Location	Mech. Room
Fluid Type	Glycol/Water
Tank Volume, usgal	120
Make/Model	Amtrol CWBT 120-4

.1 Approved Product:

.1 Amtrol Extrol series or Approved Equal in accordance with frontend clause B6.

2.3 AUTOMATIC AIR VENT

.1 Float type automatic air vent with forged brass body and cap and non-ferrous internals. Maximum operating pressure of 1034 kPa (150 psi) and temperature of 115°C (240°F).

.2 Float: solid material suitable for maximum operating temperature.

.3 Provide Isolation ball valve on all air vent connections.

.4 Approved Product:

.1 NPS 2 ½" (63 mm) and smaller: Bell and Gossett 97 or Approved Equal in accordance with frontend clause B6.

.2 NPS 3" (75 mm) and larger: Bell and Gossett 98 or Approved Equal in accordance with frontend clause B6

2.4 COALESCING AIR SEPARATOR, AS

.1 The Air & Sediment Separator shall be designed, constructed, and stamped in accordance with Section VIII, Division I of the ASME Boiler and Pressure Vessel Code, and registered with the National Board of Boiler and Pressure Vessel Inspectors.

.2 The Air & Sediment Separator shall be rated for 150 psig maximum working pressure.

.3 The Air & Sediment Separator shall have a maximum temperature rating of 450°F (232°C).

.4 The Air & Sediment Separator body shall be made of carbon steel.

.5 The Air & Sediment Separator body shall be two times the nominal inlet/outlet pipe diameter.

.6 The Air & Sediment Separator shall have an internal coalescing medium consisting of stainless steel tubes with 3/16” perforations and 51% open area. The coalescing medium shall be made of 304 Stainless Steel.

.7 Coalescing medium shall be removable to facilitate routine cleaning.

.8 The Air & Sediment Separator should be supplied with a 3rd party test report certifying that the unit can remove 99% or more of dissolved air and 96% or more of total suspended particulate.

.9 The Air & Sediment Separator shall include threaded blow down connection to allow for sediment to be regularly cleaned out of the unit.

.10 The Air & Sediment Separator shall include a threaded air removal connection on top of the unit so an air vent or expansion/compression tank can be connected, allowing collected air to be removed from the unit.

.11 The Air & Sediment Separator shall include a threaded skim valve connection on the side of the unit to allow floating sediment to be removed.

.12 The Air & Sediment Separator shall be available with either NPT end connections (2” thru 4” sizes only), flanged end connections, or grooved end connections.

.13 Flange end connections should be designed according to ANSI Standards

.14 Performance:

Tag	AS-1	AS-2	AS-3
Description	Coalescing Inline Air Separator	Coalescing Inline Air Separator	Coalescing Inline Air Separator
Location	Mech. Room	Mech Room	Mech Room
Fluid Type	Hot Water	Hot Glycol/Water	Chilled Glycol/Water

Size	6” Flanged	2” NPT	4” Flanged
Minimum Capacity	250 usgpm	55 usgpm	215 usgpm
Manufacturer/Model	Armstrong DAS-3-R	Armstrong DAS-2-R-N	Armstrong DAS-4-R

.15 Approved Product: Bell & Gossett Coalescing Inline air separator or Approved Equal in accordance with frontend clause B6.

2.5 PRESSURE SAFETY RELIEF VALVES

.1 Full compliance with ASME Code Section VIII.

.2 Elastomer or plastic seat.

.3 Single trim design.

.4 Fully balanced without the need for a Bellows.

.5 Balanced against the effects of superimposed back pressure.

.6 Corrosion resistant spring material.

.7 Acceptable Product: Crosby or Approved Equal in accordance with frontend clause B6.

2.6 MODULAR WALL SEALS

.1 Modular wall seals shall be provided when piping penetrates through existing walls and roofs.

.2 Seal Element: EPDM Blue,

.3 Pressure plates: composite.

.4 Hardware: Stainless steel nuts and bolts.

.5 Acceptable Products: Thunderline Link Seal, Innerlynx or Approved Equal in accordance with frontend clause B6.

2.7 FLOW BALANCE VALVES

.1 NPS 2 (50 mm) and under, NPT:

.1 Valve to be designed to allow installing Contractor to pre-set balance points for proportional system balance prior to system start-up in accordance with pre-set balance schedule.

.2 Threaded bronze body construction, brass ball, TFE seat rings c/w memory stop, and differential pressure readout ports. Valves to have memory stop feature to allow valve to be closed for service and then reopened to set point without disturbing balance position.

.3 All valves to have calibrated nameplate to assure specific valve setting.

.4 Valves to be leak-tight at full rated working pressure.

.5 Acceptable product: Bell & Gossett Circuit Setter Plus Model CB or Approved Equal in accordance with frontend clause B6.

.2 NPS 2-1/2 (63 mm) and over, Flanged:

.1 Valve to be designed to allow installing Contractor to pre-set balance points for proportional system balance prior to system start-up in accordance with pre-set balance schedule.
.2 Heavy duty cast iron construction with 125 psi (862 kPa) ANSI flanged connections suitable up to 175 psi (1207 kPa) working pressure.
.3 Valves 2-1/2" – 3" (63 mm – 75 mm) shall have a brass ball with glass and carbon filled TFE seat rings.
.4 Valves 4" to 12" (100 mm – 300 mm) shall be fitted with a bronze seat, replaceable bronze disc with EPDM seal insert, and stainless steel stem.
.5 Valves to have memory stop feature to allow valve to be closed for service and then reopened to set point without disturbing balance position.
.6 All valves to have calibrated nameplate to assure specific valve setting.
.7 Valves to be leak-tight at full rated working pressure.
.8 Acceptable product: Bell & Gossett Circuit Setter or Approved Equal in accordance with frontend clause B6.

2.8 GLYCOL FILL STATION

.1 System shall include minimum 100 US gallon storage/mixing tank with cover; pump suction hose with inlet strainer; pressure pump with thermal cut-out; integral pressure switch; integral check valve; cord and plug; pre-charged accumulator tank with EPDM diaphragm; manual diverter valve for purging air and agitating contents of storage tank; pressure regulating valve adjustable (5 – 55 psig) complete with pressure gauge; built-in check valve; union connection; ½" by 36" long flexible connection hose with check valve; low level pump cut-out. Pressure pump shall be capable of running dry without damage. Power supply 115/60/1. Unit shall be completely pre-assembled and certified by a recognized testing agency to CSA standard C22.2 No 68.

.2 Complete with low pressure alarm panel complete with remote monitoring dry contacts and selectable audible alarm.

.3 Approved Product: Axiom model SF100-L or Approved Equal in accordance with frontend clause B6.

2.1 HYDRONIC COILS

.1 Primary Surface: The primary surface shall be round seamless copper tube staggered in the direction of airflow.

.2 Secondary Surface: The secondary surface shall consist of rippled aluminum plate fins for higher capacity and structural strength. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Bare copper tube shall not be visible between fins. Tubes shall be mechanically

expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates.

.3 Casing: Casings shall be constructed of continuous galvanized steel with 3/8" diameter bolt holes for mounting on 6" centers. Coil side plates shall be of reinforced flange type for greater strength and ease of stacking coils in banks.

.4 Coils:

.1 Coils shall have the connections located to permit mounting of the coil and have equal pressure drop through all circuits. Coils shall be circuited to provide the maximum mean effective temperature difference for maximum heat transfer rates. All coils over 45" fin length shall be furnished with four fin angles to properly position the coil core.

.2 Contractor to confirm connection orientation (left/right hand) before installation.

.3 Headers shall be seamless copper tubing. The headers shall have intruded tube holes to provide large brazing surface for maximum strength and inherent flexibility. Coils shall be tested with 315 pounds of air under water and be suitable for operation at 250 psig and 300°F. Individual tube test and core tests before installation of headers is not considered satisfactory. Hydronic tests alone shall not be acceptable.

.5 Schedule: Refer to drawings for heating coil schedule. (Contractor to field confirm coil dimensions prior to shop drawing submittal. Modify ductwork/unit cabinet as required to suit new heating coil dimensions.)

.6 Approved Product:

.1 Greenheck or Approved Equal in accordance with frontend clause B6.

Part 3 PART 3 - EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 GENERAL

.1 Run drain lines and blow off connections to terminate above nearest drain.

.2 Maintain adequate clearance to permit service and maintenance.

.3 Should deviations beyond allowable clearances arise, request and follow Contract Administrator directive.

.4 Check shop drawings for conformance of tappings for ancillaries and for equipment operating weights.

3.3 AUTOMATIC AIR VENTS

.1 Install at high points of systems.

.2 Install at air separator as indicated by manufacturer.

.3 Install ball valve on automatic air vent inlet.

3.4 EXPANSION TANKS

.1 Adjust expansion tank pressure to suit design criteria.

3.5 PRESSURE SAFETY RELIEF VALVES

.1 Run discharge pipe to terminate above nearest drain.

3.6 SUCTION DIFFUSERS

.1 Install on inlet to pumps having suction size greater than 75mm (3in), unless indicated otherwise.

3.7 CLEANING

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 Canadian Standards Association (CSA International)

.1 CSA-B214, Installation Code for Hydronic Heating Systems.

.3 National Electrical Manufacturers' Association (NEMA)

.1 NEMA MG 1, Motors and Generators.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for pump, circulator, and equipment, and include product characteristics, performance criteria, physical size, finish and limitations indicate point of operation, and final location in field assembly.

.3 Shop Drawings:

.1 Provide shop drawing in accordance with Section 21 05 01 General Provisions – Mechanical.

.4 Submit manufacturer's detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories and controllers

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance and operation data for incorporation into manual in accordance with Section 21 05 01 General Provisions – Mechanical.

1.4 MAINTENANCE

.1 Provide maintenance materials in accordance with Section 21 05 01 General Provisions – Mechanical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.

Part 2 PRODUCTS

2.1 EQUIPMENT

.1 Size and select components to: CSA-B214.

2.2 ELECTRIC BOILER CIRCULATION PUMP, BP-01

.1 DESCRIPTION

.1 Single stage, single suction type, vertical inline pump.

.1 Seals: Close-coupled serviceable without disturbing piping connections.

.2 Include casing drain plug and 1/4 inch suction and discharge ports.

.2 DESIGN CRITERIA

.1 Design pump for constant speed applications operating at reduced pre-set speed and selected for hydraulic design conditions and minimum pressure.

.1 Design pumps to CSA C22.2 No.108.

.2 Pump Operating Conditions:

.1 100 psig at 300°F minimum to 175 psig at 140°F maximum.

.3 MATERIALS

.1 Casing: Cast iron ASTM A48, E-coated

.1 Test casing to 150 % maximum working pressure.

.2 Ensure casing is radially split to allow for removal of rotating element without disturbing pipe connections.

.3 Drill and tap casing for gauge ports on both suction and discharge connections.

.4 Drill and tap casing on bottom for drain port.

.2 Impeller: To ASTM B584, bronze, fully enclosed and dynamically balanced to ANSI G6.3 and fitted to shaft with key. Use two-plane balancing when installed impeller diameter is less than 6 times impeller width.

.3 Pump Shafts:

.1 4380 Shaft Sleeve: Brass to ASTM B111.687.

.4 Flanges: To ANSI/ASME B16.5, Class 250.

.5 Flush Line: 3/8 inch braided stainless steel complete with vent.

.6 Gasket: Synthetic fiber.

.7 Mechanical Seal: Non-Potable Fluid, Type Armstrong 2A, Inside Single Spring and rated to 230°F maximum.

.1 Rotating face: Resin Bonded Carbon.

.2 Stationary seat: Sintered Silicone carbide.

.3 Secondary seal: EPDM.

.4 Spring: Stainless steel.

.5 Rotating hardware: Stainless steel.

.6 Maximum total dissolved solids (TDS): 2000 PPM

.4 MOTOR

.1 NEMA Premium® Motor: To ANSI/NEMA MG 1

.1 Horsepower: 1 hp.

.2 Enclosure: TEFC.

.3 Efficiency: NEMA Premium 12.12.

.4 Power supply: 575/3/60

.5 ACCESSORIES

.1 Pipe Flanges: To ANSI/ASME B16.5, Class 250.

.2 Hangers and Supports: in accordance with Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.

.3 Suction Guides: For ANSI 150 flange and ANSI 125 pump flange.

.4 Triple Duty Valve: Ductile iron valve body, tight shut-off, spring -closure type silent non-slam check valve with effective throttling design capability.

.1 Valve stem: Stainless steel with flat surfaces for adjustment with open-end wrench

.5 Pressure Gauges: 4-1/2 inch diameter sized to meet system pressure requirements

.6 PERFORMANCE:

.1 Refer to schedule on drawings.

.7 ACCEPTABLE PRODUCT:

.1 Armstrong 4380 – 3x3x6 -4p -1 hp or Approved Equal in accordance with frontend clause B6.

2.3 NATURAL GAS BOILER CIRCULATION PUMP, BP-02

.1 DESCRIPTION

.1 Single stage, single suction type, vertical inline pump.

.1 Seals: Close-coupled serviceable without disturbing piping connections.

.2 Include casing drain plug and 1/4 inch suction and discharge ports.

.2 DESIGN CRITERIA

.1 Design pump for constant speed applications operating at reduced pre-set speed and selected for hydraulic design conditions and minimum pressure.

.1 Design pumps to CSA C22.2 No.108.

.2 Pump Operating Conditions:

.1 100 psig at 300°F minimum to 175 psig at 140°F maximum.

.3 MATERIALS

.1 Casing: Cast iron ASTM A48, E-coated

.1 Test casing to 150 % maximum working pressure.

.2 Ensure casing is radially split to allow for removal of rotating element without disturbing pipe connections.

.3 Drill and tap casing for gauge ports on both suction and discharge connections.

.4 Drill and tap casing on bottom for drain port.

.2 Impeller: To ASTM B584, bronze, fully enclosed and dynamically balanced to ANSI G6.3 and fitted to shaft with key. Use two-plane balancing when installed impeller diameter is less than 6 times impeller width.

.3 Pump Shafts:

.1 4380 Shaft Sleeve: Brass to ASTM B111.687.

.4 Flanges: To ANSI/ASME B16.5, Class 250.

.5 Flush Line: 3/8 inch braided stainless steel complete with vent.

.6 Gasket: Synthetic fiber.

.7 Mechanical Seal: Non-Potable Fluid, Type Armstrong 2A, Inside Single Spring and rated to 230°F maximum.

.1 Rotating face: Resin Bonded Carbon.

.2 Stationary seat: Sintered Silicone carbide.

.3 Secondary seal: EPDM.

.4 Spring: Stainless steel.

.5 Rotating hardware: Stainless steel.

.6 Maximum total dissolved solids (TDS): 2000 PPM

.4 MOTOR

.1 NEMA Premium® Motor: To ANSI/NEMA MG 1

.1 Horsepower: 1 hp.

.2 Enclosure: TEFC.

.3 Efficiency: NEMA Premium 12.12.

.4 Power supply: 575/3/60

.5 VFD

.1 The integrated control shall convert incoming fixed frequency three-phase AC power into an adjustable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for the driven load and to eliminate the need for motor derating.

.2 When properly sized, the integrated control shall allow the motor to produce full rated power at rated motor voltage, current, and speed without using the motor's service factor. integrated controls utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.

.3 The integrated control shall include an input full-wave bridge rectifier and maintain a fundamental (displacement) power factor near unity regardless of speed or load. The integrated control shall have a dual 5% impedance DC link reactor on the positive and negative rails of the DC bus to minimize power line harmonics and protect the integrated control from power line transients. The chokes shall be non-saturating. Swinging chokes that do not provide full harmonic filtering throughout the entire load range are not acceptable. integrated controls with saturating (non-linear) DC link reactors shall require an additional 3% AC line reactor to provide acceptable harmonic performance at full load, where harmonic performance is most critical.

.4 The integrated control's full load output current rating shall meet or exceed NEC Table 430-150. The integrated control shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 120% of rated torque for up to 0.5 second while starting.

.5 The integrated control shall provide full motor torque at any selected frequency from 20 Hz to base speed while providing a variable torque V/Hz output at reduced speed. This is to allow driving centrifugal pumps without high speed derating or low speed excessive magnetization, as would occur if a constant torque V/Hz curve was used at reduced speeds. Breakaway current of 160% shall be available.

.6 A programmable automatic energy optimization selection feature shall be provided standard in the integrated control. This feature shall automatically and continuously monitor the motor's speed and load to adjust the applied voltage to maximize energy savings.

.7 The integrated control must be able to produce full torque at low speed to operate centrifugal pumps.

.8 Output power circuit switching shall be able to be accomplished without interlocks or damage to the integrated control.

.9 An automatic motor adaptation algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to perform the test.

.10 Galvanic isolation shall be provided between the integrated control's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. integrated controls not including either galvanic or optical isolation on both analog I/O and discrete digital I/O shall include additional isolation modules.

.11 Integrated control shall minimize the audible motor noise through the use of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and integrated control operation while reducing motor noise. Integrated controls with fixed carrier frequency are not acceptable.

.12 All integrated controls shall contain integral EMI filters to attenuate radio frequency interference conducted to the AC power line.

.13 PROTECTIVE FEATURES:

.1 A minimum of Class 20 I2t electronic motor overload protection for single motor applications shall be provided. Overload protection shall automatically compensate for changes in motor speed.

.2 Protection against input transients, loss of AC line phase, output short circuit, output ground fault, over voltage, under voltage, integrated control over temperature and motor over temperature. The integrated control shall display all faults in plain language. Codes are not acceptable.

.3 Protect integrated control from input phase loss. The integrated control should be able to protect itself from damage and indicate the phase loss condition. During an input phase loss condition, the integrated control shall be able to be programmed to either trip off while displaying an alarm, issue a warning while running at reduced output capacity, or issue a warning while running at full commanded speed. This function is independent of which input power phase is lost.

.4 Protect from under voltage. The integrated control shall provide full rated output with an input voltage as low as 90% of the nominal. The integrated control will continue to operate with reduced output, without faulting, with an input voltage as low as 70% of the nominal voltage.

.5 Control shall continue to operate without faulting with a momentary input voltage as high as 130% of the nominal voltage.

.6 The integrated control shall incorporate a programmable motor preheat feature to keep the motor warm and prevent condensation build up in the motor when it is stopped in a damp environment by providing the motor stator with a controlled level of current.

.7 Integrated control shall include a “signal loss detection” algorithm with adjustable time delay to sense the loss of an analog input signal. It shall also include a programmable time delay to eliminate nuisance signal loss indications. The functions after detection shall be programmable.

.8 Integrated control shall function normally when the keypad is removed while the integrated control is running. No warnings or alarms shall be issued as a result of removing the keypad.

.9 Integrated control shall catch a rotating motor operating forward or reverse up to full speed without integrated control fault or component damage.

.10 Selectable over-voltage control shall be provided to protect the drive from power regenerated by the motor while maintaining control of the driven load.

.11 Integrated control shall include current sensors on all three output phases to accurately measure motor current, protect the integrated

control from output short circuits, output ground faults, and act as a motor overload. If an output phase loss is detected, the integrated control will trip off and identify which of the output phases is low or lost.

.12 If the temperature of the integrated control's heat sink rises to 80°C (176°F), the integrated control shall automatically reduce its carrier frequency to reduce the heat sink temperature. It shall also be possible to program the integrated control so that it reduces its output current limit value if the integrated control's temperature becomes too high.

.13 In order to ensure operation during periods of overload, it must be possible to program the integrated control to automatically reduce its output current to a programmed value during periods of excessive load. This allows the integrated control to continue to run the load without tripping.

.14 The integrated control shall have temperature-controlled cooling fan(s) for quiet operation, minimized losses, and increased fan life. At low loads or low ambient temperatures, the fan(s) may be off even when the integrated control is running.

.15 The integrated control shall store in memory the last 10 alarms. A description of the alarm, and the date and time of the alarm shall be recorded.

.14 INTERFACE FEATURES

.1 Hand, Off and Auto keys shall be provided to start and stop the integrated control and determine the source of the speed reference. It shall be possible to either disable these keys or password protect them from undesired operation.

.2 The integrated control shall be programmable to provide a digital output signal to indicate whether the integrated control is in Hand or Auto mode. This is to alert the Building Automation System whether the integrated control is being controlled locally or by the Building Automation System.

.3 Password protected keypad with alphanumeric, graphical, backlit display can be remotely mounted. Two levels of password protection shall be provided to guard against unauthorized parameter changes.

.4 All integrated controls shall have the same customer interface. The keypad and display shall be identical and interchangeable for all sizes of integrated controls.

.5 To set up multiple integrated controls, it shall be possible to upload all setup parameters to the integrated control's keypad, place that keypad on all other integrated controls in turn and download the setup parameters to each integrated control. To facilitate setting up integrated controls of various sizes, it shall be possible to download

from the keypad only size independent parameters. Keypad shall provide visual indication of copy status.

.6 Display shall be programmable to communicate in multiple languages including English, Spanish and French.

.7 A quick setup menu with factory pre-set typical HVAC parameters shall be provided on the integrated control. The integrated control shall also have menus specifically designed to facilitate start-up of pump applications.

.8 A three-feedback PID controller to control the speed of the integrated control shall be standard.

.1 This controller shall accept up to three feedback signals. It shall be programmable to compare the feedback signals to a common setpoint or to individual setpoints and to automatically select either the maximum or the feedback signal as the controlling signal. It shall also be possible to calculate the controlling feedback signal as the average of all feedback signals or the difference between a pair of feedback signals.

.2 The integrated control shall be able to apply individual scaling to each feedback signal.

.3 The integrated control's PID controller shall be able to actively adjust its setpoint based on flow. This allows the integrated control to compensate for a pressure feedback sensor which is located near the output of the pump rather than out in the controlled system.

.9 The integrated control shall have three additional PID controllers which can be used to control damper and valve positioners in the system and to provide setpoint reset.

.10 Floating point control interface shall be provided to increase/decrease speed in response to contact closures.

.11 Five simultaneous meter displays shall be available. They shall include at a minimum, frequency, motor current, motor voltage, integrated control output power, integrated control output energy, integrated control temperature in degrees, among others.

.12 Programmable Sleep Mode shall be able to stop the integrated control. When its output frequency drops below set "sleep" level for a specified time, when an external contact commands that the integrated control go into Sleep Mode, or when the integrated control detects a no-flow situation, the integrated control may be programmed to stop. When the integrated control's speed is being controlled by its PID controller, it shall be possible to program a "wake-up" feedback value that will cause the integrated control to start. To avoid excessive starting and stopping of the driven equipment, it shall be possible to program a minimum run time

before sleep mode can be initiated and a minimum sleep time for the integrated control.

.13 A run permissive circuit shall be provided to accept a "system ready" signal to ensure that the integrated control does not start until dampers or other auxiliary equipment are in the proper state for integrated control operation. The run permissive circuit shall also be capable of initiating an output "run request" signal to indicate to the external equipment that the integrated control has received a request to run.

.14 Integrated control shall be programmable to display feedback signals in appropriate units, such as inches of water column (in-wg), pressure per square inch (psi) or temperature (°F/°C).

.15 Integrated control shall be programmable to sense the loss of load. The integrated control shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. To ensure against nuisance indications, this feature must be based on motor torque, not current, and must include a proof timer to keep brief periods of no load from falsely triggering this indication.

.16 Standard Control and Monitoring Inputs and Outputs

.1 Four dedicated, programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.

.2 Two terminals shall be programmable to act as either digital outputs or additional digital inputs.

.3 Two programmable relay outputs, Form C 240 V AC, 2 A, hall be provided for remote indication of integrated control status

.1 Each relay shall have an adjustable on delay / off delay time.

.4 Two programmable analog inputs shall be provided that can be either direct-or-reverse acting.

.1 Each shall be independently selectable to be used with either an analog voltage or current signal.

.2 The maximum and minimum range of each shall be able to be independently scalable from 0 to 10 V dc and 0 to 20 mA.

.3 A programmable low-pass filter for either or both of the analog inputs must be included to compensate for noise.

.4 The integrated control shall provide front panel meter displays programmable to show the value of each analog input signal for system set-up and troubleshooting.

.5 One programmable analog current output (0/4 to 20 mA) shall be provided for indication of integrated control status. This output shall be programmable to show the reference or feedback signal supplied to the integrated control and for integrated control output frequency, current and power. It shall be possible to scale the minimum and maximum values of this output.

.6 It shall be possible through serial bus communications to read the status of all analog and digital inputs of the integrated control.

.7 It shall be possible to command all digital and analog output through the serial communication bus.

.17 Optional Control and Monitoring Inputs and Outputs.

.1 It shall be possible to add optional modules to the integrated control in the field to expand its analog and digital inputs and outputs.

.2 These modules shall use rigid connectors to plug into the integrated control's control card.

.3 The integrated control shall automatically recognize the option module after it is powered up. There shall be no need to manually configure the module.

.4 Modules may include such items as:

.1 Additional digital outputs, including relay outputs.

.2 Additional digital inputs.

.3 Additional analog outputs

.4 Additional analog inputs, including Ni or Pt temperature sensor inputs.

.5 It shall be possible through serial bus communications to control the status of all optional analog and digital outputs of the integrated control.

.18 Standard programmable firefighter's override mode allows a digital input to control the integrated control and override all other local or remote commands. It shall be possible to program the integrated control so that it will ignore most normal integrated control safety circuits including motor overload. The integrated control shall display FIREMODE whenever in firefighter's override mode. Fire mode shall allow selection of forward or reverse operation and the selection of a speed source or pre-set speed, as required to accommodate local fire codes, standards and conditions.

.19 A real-time clock shall be an integral part of the integrated control.

.1 It shall be possible to use this to display the current date and time on the integrated control's display.

.2 Ten programmable time periods, with individually selectable ON and OFF functions shall be available. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter setpoints and output relays. It shall be possible to program unique events that occur only during normal work days, others that occur only on non-work days, and others that occur on specific days or dates. The manufacturer shall provide free PC-based software to set up the calendar for this schedule.

.3 All integrated control faults shall be time stamped to aid troubleshooting.

.4 It shall be possible to program maintenance reminders based on date and time, integrated control running hours, or integrated control operating hours.

.5 The real-time clock shall be able to time and date stamp all faults recorded in the integrated control fault log.

.20 The integrated control shall be able to store load profile data to assist in analyzing the system demand and energy consumption over time.

.21 The integrated control shall include a sequential logic controller to provide advanced control interface capabilities. This shall include:

.1 Comparators for comparing integrated control analog values to programmed trigger values

.2 Logic operators to combine up to three logic expressions using Boolean algebra

.3 Delay timers

.4 A 20-step programmable structure

.22 The integrated control shall include a Cascade Controller which allows the integrated control to operate in closed loop set point (PID) control mode one motor at a controlled speed and control the operation of 3 additional constant speed motor starters.

.1 Sensor less control software shall be embedded in the IVS unit to provide automatic speed control in variable volume systems without the need for pump mounted (internal/external) or remotely mounted differential pressure sensor.

.2 The default operating mode under Sensor Less Control shall be 'quadratic pressure control' whereby head reduction with reducing flow will be according to a quadratic control curve.

.3 Control mode setting and minimum / maximum head set-points shall be user adjustable via the inbuilt programming interface.

.15 SERIAL COMMUNICATIONS

.1 The integrated control shall include a standard EIA-485 communications port and capabilities to be connected to the following serial communication protocols at no additional cost and without a need to install any additional hardware or software in the integrated control:

.1 Modbus RTU

.2 BACnet Native (default)

.3 Johnson Controls Metasys N2

.4 Siemens FLN

.2 Integrated control shall have standard USB port for direct connection of Personal Computer (PC) to the integrated control. The manufacturer shall provide no-charge PC software to allow complete setup and access of the integrated control and logs of integrated control operation through the USB port. It shall be possible to communicate to the integrated control through this USB port without interrupting integrated control communications to the building management system.

.3 The integrated control shall have provisions for an optional 24 V DC back-up power interface to power the integrated control's control card. This is to allow the integrated control to continue to communicate to the building automation system even if power to the integrated control is lost.

.16 ADJUSTMENTS

.1 The integrated control shall have a manually adjustable carrier frequency that can be adjusted in 0.5 kHz increments to allow the user to select the desired operating characteristics. The integrated control shall also be programmable to automatically reduce its carrier frequency to avoid tripping due to thermal loading.

.2 Four independent setups shall be provided.

.3 Four pre-set speeds per setup shall be provided for a total of 16.

.4 Each setup shall have two programmable ramp up and ramp down times. Acceleration and deceleration ramp times shall be adjustable over the range from 1 to 3,600 seconds.

.5 Each setup shall be programmable for a unique current limit value. If the output current from the integrated control reaches this value, any further attempt to increase the current produced by the integrated control will cause the integrated control to reduce its output frequency to reduce the load on the integrated control. If desired, it shall be possible to program a timer which will cause the integrated control to trip off after a programmed time period.

.6 If the integrated control trips on one of the following conditions, the integrated control shall be programmable for automatic or manual

reset: external interlock, under-voltage, over-voltage, current limit, over temperature, and integrated control overload.

.7 The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.

.8 An automatic “start delay” may be selected from 0 to 120 seconds. During this delay time, the integrated control shall be programmable to either apply no voltage to the motor or apply a DC braking current if desired.

.9 Four programmable critical frequency lockout ranges to prevent the integrated control from operating the load at a speed that causes vibration in the driven equipment shall be provided. Semi-automatic setting of lockout ranges shall simplify the setup.

.17 OPTIONAL FEATURES

.1 All optional features shall be UL listed as a complete assembly and carry a UL label.

.2 All panels shall be marked for their short circuit current rating in compliance with UL.

.18 SERVICE CONDITIONS

.1 Ambient temperature, continuous, full speed, full load operation:

.1 -10 to 45°C (14 to 113°F) through 125 HP @ 460 and 600 volts, through 60 HP @ 208 volts

.2 -10 to 40°C (14 to 104°F) 150 HP and larger

.2 0 to 95% relative humidity, non-condensing.

.3 Elevation to 3,300 feet without derating.

.4 AC line voltage variation, -10 to +10% of nominal with full output.

.5 No side clearance shall be required for cooling.

.6 All power and control wiring shall be done from the bottom.

.6 ACCESSORIES

.1 Pipe Flanges: To ANSI/ASME B16.5, Class 250.

.2 Hangers and Supports: in accordance with Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.

.3 Suction Guides: For ANSI 150 flange and ANSI 125 pump flange.

.4 Triple Duty Valve: Ductile iron valve body, tight shut-off, spring -closure type silent non-slam check valve with effective throttling design capability.

.1 Valve stem: Stainless steel with flat surfaces for adjustment with open-end wrench

.5 Pressure Gauges: 4-1/2 inch diameter sized to meet system pressure requirements

.7 PERFORMANCE:

.1 Refer to schedule on drawings.

.8 ACCEPTABLE PRODUCT:

.1 Armstrong 4380 – 3x3x6 -4p -1 hp - PD or Approved Equal in accordance with frontend clause B6.

2.4 HYDRONIC HEATING SYSTEM CIRCULATING PUMPS, CP-01 & CP-02

.1 DESCRIPTION

.1 Single stage, single suction type, vertical inline pump.

.1 Seals: Close-coupled serviceable without disturbing piping connections.

.2 Include casing drain plug and 1/4 inch suction and discharge ports.

.2 DESIGN CRITERIA

.1 Design pump for variable flow applications and selected for hydraulic design conditions and minimum system pressure with pressure sensor across most remote load.

.1 Select hydraulic design conditions and minimum pressure with pressure sensor across most remote load.

.2 Design pumps to UL STD 778 & CSA C22.2 No.108.

.2 Pump Operating Conditions:

.1 100 psig at 300°F minimum to 175 psig at 140°F maximum.

.3 MATERIALS

.1 Casing: Ductile iron ASTM A536, E-coated

.1 Test casing to 150 % maximum working pressure.

.2 Ensure casing is radially split to allow for removal of rotating element without disturbing pipe connections.

.3 Casing wetted surfaces shall be e-coated to prevent seizing of impeller to casing after periods of inactivity.

.4 Drill and tap casing for gauge ports on both suction and discharge connections.

.5 Drill and tap casing on bottom for drain port.

.2 Impeller: To ASTM A743 CF8M, stainless steel 316, fully enclosed and dynamically balanced to ANSI G6.3 and fitted to shaft with key. Use two-plane balancing when installed impeller diameter is less than 6 times impeller width.

.3 Pump Shafts:

.1 4380 Close-coupled: Steel motor shaft with Shaft Sleeve: Stainless steel to 316SS ASTM A479.

.4 Flanges: ANSI-125.

.5 Flush Line: 3/8 inch braided stainless steel complete with vent.

.6 Casing O-ring: EPDM.

.7 Mechanical Seal: Non-Potable Fluid, Type Armstrong 2A, Inside Single Spring and rated to 250°F maximum.

.1 Rotating face: Resin Bonded Carbon.

.2 Stationary seat: Sintered Silicone carbide.

.3 Seal rotating hardware: Stainless Steel.

.4 Secondary / shaft seal elastomer: EPDM

.5 Maximum total dissolved solids (TDS): 2000 PPM

.4 MOTOR

.1 DEPM Motor: To IE5 efficiency

.1 Horsepower: 7.5 hp.

.2 Enclosure: TEFC.

.3 Efficiency: IE5

.4 Power supply: 575/3/60

.5 PUMP CONTROLS

.1 Control: Integrated with UL Type 12/IP55 minimum enclosure rating, sensorless controls complete with fused disconnect switch and menu-driven graphical keypad interface.

.2 Provide near unity displacement power factor (cos Ø) without need for external power factor correction capacitors at all loads and speeds using VVC-PWM type integrated controls

.1 Incorporate DC link reactors for reduction of mains borne harmonic currents and DC link ripple current to increase DC link capacitor lifetime.

.2 Fit RFI filters as standard to ensure integrated controls meets low emission and immunity requirements.

.3 Ensure additional 3 % AC line reactor is available for controls with saturating (nonlinear) DC link reactors.

.4 Orientation: By Contractor to ensure maintenance access.

.5 Communication protocol: Default Field Reconfigurable

.6 Sensorless override for BAS/BMS control signal.

.7 Manual pump control/ Closed loop PID control

.8 Enclosure: UL Type 12/IP55

.9 EMI/RFI Control: Integrated filter designed to DIN EN61800-3.

.10 Harmonic suppression: Dual DC-link reactors (Equivalent: 5% impedance AC line reactor) to mitigate

.11 Harmonics to support IEEE 519 system requirements.

.12 Cooling: Fan cooled through back panel.

.13 Ambient working conditions: 113°F / 45°C, up to 3300 feet above sea level.

.14 Analog I/O: 2 inputs minimum, 1 output minimum. Output can be configured for voltage or current.

.15 Digital I/O: 2 inputs minimum, 2 outputs minimum. Outputs can be configured as inputs.

.16 Pulse inputs: 2 programmable minimum.

.17 Relay outputs: 2 programmable minimum.

.18 Communications ports: 1- RS485

.19 One volt free contact.

.20 Auto alarm reset.

.3 Software: Ensure software for sensorless control includes automatic speed control in variable volume systems without need for pump mounted (internal/external) or remotely mounted differential pressure sensor.

.1 Operating mode under sensorless control: Quadratic Pressure Control (QPC).

.1 Ensure head reduction with reducing flow conforms to quadratic control curve.

.2 Head at zero flow: 40% minimum of design duty head.

.2 Linear or Proportional Pressure Control without sensor is unacceptable.

.3 Ensure control mode setting and minimum/maximum head set points are user adjustable using built-in programming interface.

.4 Ensure integrated control software is capable of controlling pump performance for non-overloading power at every point of operation.

.5 Ensure integrated control software is capable of flow rate display and data output of ± 5% accuracy to BAS/BMS.

.6 Ensure the controls can displayed and digitally transmit real-time flow & values.

.4 Include energy monitoring log function to ASHRAE 189.1P.

.5 For multiple pump configuration ensure parallel Sensorless pump control with best efficiency staging is applied.

.6 PUMP MOTOR AND CONTROLS PROTECTION

.1 Include protection as follows:

.1 Motor phase to phase fault.

.2 Motor phase to ground fault.

.3 Loss of supply phase.

.4 Over voltage.

.5 Under voltage.

.6 Motor over temperature.

.7 Inverter overload.

.8 Over current

.7 FABRICATION

.1 Install integrated controls on each pump for use with BAS/BMS for energy logging to ASHRAE 189.1P.
.2 Pre-program integrated intelligent controls for each pump before pump leaves factory.
.1 Install flush / vent line in factory.
.1 Ensure flush / vent line runs from seal chamber to pump suction.
.2 Mark pumps and controls with co-ordinated identification.

.8 ACCESSORIES

.1 Pipe Flanges: To ANSI/ASME B16.5, Class 150.
.2 Hangers and Supports: in accordance with Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.
.3 Suction Guides: For ANSI 150 flange and ANSI 125 pump flange.
.4 Triple Duty Valve: Ductile iron valve body, tight shut-off, spring -closure type silent non-slam check valve with effective throttling design capability.
.1 Valve stem: Stainless steel with flat surfaces for adjustment with open-end wrench
.5 Pressure Gauges: 4-1/2 inch diameter sized to meet system pressure requirements

.9 PERFORMANCE:

.1 Refer to schedule on drawings.

.10 ACCEPTABLE PRODUCT:

.1 Armstrong 4380 2505-007.5 or Approved Equal in accordance with frontend clause B6.

2.5 GLYCOL HEATING CIRCULATION PUMPS, GP-01 & GP-02

.1 DESCRIPTION

.1 Single stage, single suction type, vertical inline pump.
.1 Seals: Close-coupled serviceable without disturbing piping connections.
.2 Include casing drain plug and 1/4 inch suction and discharge ports.

.2 DESIGN CRITERIA

.1 Design pump for variable flow applications and selected for hydraulic design conditions and minimum system pressure with sensorless load Demand Based control.
.1 Select hydraulic design conditions and minimum pressure with sensorless load control.
.2 For Sensorless control the operating control curve shall be quadratic with adjustable minimum head setting.
.3 Design pumps to UL STD 778 & CSA C22.2 No.108.

.2 Pump Operating Conditions:

.1 100 psig at 300°F minimum to 175 psig at 140°F maximum.

.3 MATERIALS

.1 Casing: Ductile iron ASTM A536, E-coated

.1 Test casing to 150 % maximum working pressure.

.2 Ensure casing is radially split to allow for removal of rotating element without disturbing pipe connections.

.3 Casing wetted surfaces shall be e-coated to prevent seizing of impeller to casing after periods of inactivity.

.4 Drill and tap casing for gauge ports on both suction and discharge connections.

.5 Drill and tap casing on bottom for drain port.

.2 Impeller: To ASTM A743 CF8M, stainless steel 316, fully enclosed and dynamically balanced to ANSI G6.3 and fitted to shaft with key. Use two-plane balancing when installed impeller diameter is less than 6 times impeller width.

.3 Pump Shafts:

.1 4380 Close-coupled: Steel motor shaft with Shaft Sleeve: Stainless steel to 316SS ASTM A479.

.4 Flanges: ANSI-125.

.5 Flush Line: 3/8 inch braided stainless steel complete with vent.

.6 Casing O-ring: EPDM.

.7 Mechanical Seal: Non-Potable Fluid, Type Armstrong 2A, Inside Single Spring and rated to 250°F maximum.

.1 Rotating face: Resin Bonded Carbon.

.2 Stationary seat: Sintered Silicone carbide.

.3 Seal rotating hardware: Stainless Steel.

.4 Secondary / shaft seal elastomer: EPDM

.5 Maximum total dissolved solids (TDS): 4000 PPM

.4 MOTOR

.1 DEPM Motor: To IE5 efficiency

.1 Horsepower: 1.5 hp.

.2 Enclosure: TEFC.

.3 Efficiency: IE5

.4 Power supply: 575/3/60

.5 PUMP CONTROLS

.1 Control: Integrated with UL Type 12/IP55 minimum enclosure rating, sensorless controls complete with fused disconnect switch and menu-driven graphical keypad interface.

.2 Provide near unity displacement power factor (cos Ø) without need for external power factor correction capacitors at all loads and speeds using VVC-PWM type integrated controls

.1 Incorporate DC link reactors for reduction of mains borne harmonic currents and DC link ripple current to increase DC link capacitor lifetime.

.2 Fit RFI filters as standard to ensure integrated controls meets low emission and immunity requirements.

.3 Ensure additional 3 % AC line reactor is available for controls with saturating (nonlinear) DC link reactors.

.4 Orientation: By Contractor to ensure maintenance access.

.5 Communication protocol: Default Field Reconfigurable

.6 Sensorless override for BAS/BMS control signal.

.7 Manual pump control/ Closed loop PID control

.8 Enclosure: UL Type 12/IP55

.9 EMI/RFI Control: Integrated filter designed to DIN EN61800-3.

.10 Harmonic suppression: Dual DC-link reactors (Equivalent: 5% impedance AC line reactor) to mitigate

.11 Harmonics to support IEEE 519 system requirements.

.12 Cooling: Fan cooled through back panel.

.13 Ambient working conditions: 113°F / 45°C, up to 3300 feet above sea level.

.14 Analog I/O: 2 inputs minimum, 1 output minimum. Output can be configured for voltage or current.

.15 Digital I/O: 2 inputs minimum, 2 outputs minimum. Outputs can be configured as inputs.

.16 Pulse inputs: 2 programmable minimum.

.17 Relay outputs: 2 programmable minimum.

.18 Communications ports: 1- RS485

.19 One volt free contact.

.20 Auto alarm reset.

.3 Software: Ensure software for sensorless control includes automatic speed control in variable volume systems without need for pump mounted (internal/external) or remotely mounted differential pressure sensor.

.1 Operating mode under sensorless control: Quadratic Pressure Control (QPC).

.1 Ensure head reduction with reducing flow conforms to quadratic control curve.

.2 Head at zero flow: 40% minimum of design duty head.

.2 Linear or Proportional Pressure Control without sensor is unacceptable.

.3 Ensure control mode setting and minimum/maximum head set points are user adjustable using built-in programming interface.

.4 Ensure integrated control software is capable of controlling pump performance for non-overloading power at every point of operation.

.5 Ensure integrated control software is capable of flow rate display and data output of ± 5% accuracy to BAS/BMS.

.6 Ensure the controls can displayed and digitally transmit real-time flow & values.

.4 Include energy monitoring log function to ASHRAE 189.1P.

.5 For multiple pump configuration ensure parallel Sensorless pump control with best efficiency staging is applied.

.6 PUMP MOTOR AND CONTROLS PROTECTION

.1 Include protection as follows:

.1 Motor phase to phase fault.

.2 Motor phase to ground fault.

.3 Loss of supply phase.

.4 Over voltage.

.5 Under voltage.

.6 Motor over temperature.

.7 Inverter overload.

.8 Over current

.7 FABRICATION

.1 Install integrated controls on each pump for use with BAS/BMS for energy logging to ASHRAE 189.1P.

.2 Pre-program integrated intelligent controls for each pump before pump leaves factory.

.1 Install flush / vent line in factory.

.1 Ensure flush / vent line runs from seal chamber to pump suction.

.2 Mark pumps and controls with co-ordinated identification.

.8 ACCESSORIES

.1 Pipe Flanges: To ANSI/ASME B16.5, Class 150.

.2 Hangers and Supports: in accordance with Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.

.3 Suction Guides: For ANSI 150 flange and ANSI 125 pump flange.

.4 Triple Duty Valve: Ductile iron valve body, tight shut-off, spring -closure type silent non-slam check valve with effective throttling design capability.

.1 Valve stem: Stainless steel with flat surfaces for adjustment with open-end wrench

.5 Pressure Gauges: 4-1/2 inch diameter sized to meet system pressure requirements

.9 PERFORMANCE:

.1 Refer to schedule on drawings.

.10 ACCEPTABLE PRODUCT:

.1 Armstrong 4380 1205-001.5 or Approved Equal in accordance with frontend clause B6.

2.6 CHILLED WATER/GLYCOL CIRCULATING PUMPS, CWP-01 & CWP-02

.1 DESCRIPTION

.1 Single stage, single suction type, vertical inline pump.

.1 Seals: Close-coupled serviceable without disturbing piping connections.

.2 Include casing drain plug and 1/4 inch suction and discharge ports.

.2 Design pump for variable flow applications and selected for hydraulic design conditions and minimum system pressure with sensorless load Demand Based control.

.1 Select hydraulic design conditions and minimum pressure with sensorless load control.

.2 For Sensorless control the operating control curve shall be quadratic with adjustable minimum head setting.

.3 Design pumps to UL STD 778 & CSA C22.2 No.108.

.3 Pump Operating Conditions:

.1 100 psig at 300°F minimum to 175 psig at 140°F maximum.

.2 MATERIALS

.1 Casing: Ductile iron ASTM A536, E-coated

.1 Test casing to 150 % maximum working pressure.

.2 Ensure casing is radially split to allow for removal of rotating element without disturbing pipe connections.

.3 Casing wetted surfaces shall be e-coated to prevent seizing of impeller to casing after periods of inactivity.

.4 Drill and tap casing for gauge ports on both suction and discharge connections.

.5 Drill and tap casing on bottom for drain port.

.2 Impeller: To ASTM A743 CF8M, stainless steel 316, fully enclosed and dynamically balanced to ANSI G6.3 and fitted to shaft with key. Use two-plane balancing when installed impeller diameter is less than 6 times impeller width.

.3 Pump Shafts:

.1 4380 Close-coupled: Steel motor shaft with Shaft Sleeve: Stainless steel to 316SS ASTM A479.

.4 Flanges: ANSI-125.

.5 Flush Line: 3/8 inch braided stainless steel complete with vent.

.6 Casing O-ring: EPDM.

.7 Mechanical Seal: Non-Potable Fluid, Type Armstrong 2A, Inside Single Spring and rated to 250°F maximum.

.1 Rotating face: Resin Bonded Carbon.

.2 Stationary seat: Sintered Silicone carbide.

.3 Seal rotating hardware: Stainless Steel.

.4 Secondary / shaft seal elastomer: EPDM

.5 Maximum total dissolved solids (TDS): 4000 PPM

.3 MOTOR

.1 DEPM Motor: To IE5 efficiency

.1 Horsepower: 10 hp.

.2 Enclosure: TEFC.

.3 Efficiency: IE5

.4 Power supply: 575/3/60

.4 PUMP CONTROLS

.1 Control: Integrated with UL Type 12/IP55 minimum enclosure rating, sensorless controls complete with fused disconnect switch and menu-driven graphical keypad interface.

.2 Provide near unity displacement power factor (cos Ø) without need for external power factor correction capacitors at all loads and speeds using VVC-PWM type integrated controls

.1 Incorporate DC link reactors for reduction of mains borne harmonic currents and DC link ripple current to increase DC link capacitor lifetime.

.2 Fit RFI filters as standard to ensure integrated controls meets low emission and immunity requirements.

.3 Ensure additional 3 % AC line reactor is available for controls with saturating (nonlinear) DC link reactors.

.4 Orientation: By Contractor to ensure maintenance access.

.5 Communication protocol: Default Field Reconfigurable

.6 Sensorless override for BAS/BMS control signal.

.7 Manual pump control/ Closed loop PID control

.8 Enclosure: UL Type 12/IP55

.9 EMI/RFI Control: Integrated filter designed to DIN EN61800-3.

.10 Harmonic suppression: Dual DC-link reactors (Equivalent: 5% impedance AC line reactor) to mitigate

.11 Harmonics to support IEEE 519 system requirements.

.12 Cooling: Fan cooled through back panel.

.13 Ambient working conditions: 113°F / 45°C, up to 3300 feet above sea level.

.14 Analog I/O: 2 inputs minimum, 1 output minimum. Output can be configured for voltage or current.

.15 Digital I/O: 2 inputs minimum, 2 outputs minimum. Outputs can be configured as inputs.

.16 Pulse inputs: 2 programmable minimum.

.17 Relay outputs: 2 programmable minimum.

.18 Communications ports: 1- RS485

.19 One volt free contact.

.20 Auto alarm reset.

.3 Software: Ensure software for sensorless control includes automatic speed control in variable volume systems without need for pump mounted (internal/external) or remotely mounted differential pressure sensor.

.1 Operating mode under sensorless control: Quadratic Pressure Control (QPC).

.1 Ensure head reduction with reducing flow conforms to quadratic control curve.

.2 Head at zero flow: 40% minimum of design duty head.

.2 Linear or Proportional Pressure Control without sensor is unacceptable.

.3 Ensure control mode setting and minimum/maximum head set points are user adjustable using built-in programming interface.

.4 Ensure integrated control software is capable of controlling pump performance for non-overloading power at every point of operation.

.5 Ensure integrated control software is capable of flow rate display and data output of ± 5% accuracy to BAS/BMS.

.6 Ensure the controls can displayed and digitally transmit real-time flow & values.

.4 Include energy monitoring log function to ASHRAE 189.1P.

.5 For multiple pump configuration ensure parallel Sensorless pump control with best efficiency staging is applied.

.5 PUMP MOTOR AND CONTROLS PROTECTION

.1 Include protection as follows:

.1 Motor phase to phase fault.

.2 Motor phase to ground fault.

.3 Loss of supply phase.

.4 Over voltage.

.5 Under voltage.

.6 Motor over temperature.

.7 Inverter overload.

.8 Over current

.6 FABRICATION

.1 Install integrated controls on each pump for use with BAS/BMS for energy logging to ASHRAE 189.1P.

.2 Pre-program integrated intelligent controls for each pump before pump leaves factory.

.1 Install flush / vent line in factory.

.1 Ensure flush / vent line runs from seal chamber to pump suction.

.2 Mark pumps and controls with co-ordinated identification.

.7 ACCESSORIES

.1 Pipe Flanges: To ANSI/ASME B16.5, Class 150.

.2 Hangers and Supports: in accordance with Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.

.3 Suction Guides: For ANSI 150 flange and ANSI 125 pump flange.

.4 Triple Duty Valve: Ductile iron valve body, tight shut-off, spring -closure type silent non-slam check valve with effective throttling design capability.

.1 Valve stem: Stainless steel with flat surfaces for adjustment with open-end wrench

.5 Pressure Gauges: 4-1/2 inch diameter sized to meet system pressure requirements

.8 PERFORMANCE:

.1 Refer to schedule on drawings.

.9 ACCEPTABLE PRODUCT:

.1 Armstrong 4380 0205-010.0 or Approved Equal in accordance with frontend clause B6.

Part 3 EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install hydronic pumps to: CSA-B214.

.2 Install in conformance with manufacturer's written recommendations.

.3 In line circulators: install as indicated by flow arrows.

.1 Support at inlet and outlet flanges or unions.
.2 Install with bearing lubrication points accessible.

.4 Base mounted type: supply templates for anchor bolt placement.

.1 Include anchor bolts with sleeves. Place level, shim unit and grout.
.2 Align coupling in accordance with manufacturer's recommended tolerance.
.3 Check oil level and lubricate. After run-in, tighten glands.

.5 Ensure that pump body does not support piping or equipment.

.1 Provide stanchions or hangers for this purpose.
.2 Refer to manufacturer's installation instructions for details.

.6 Pipe drain tapping to floor drain.

.7 Install volute venting pet cock in accessible location.

.8 Check rotation prior to start-up.

.9 Install pressure gauge test cocks.

3.3 START-UP

.1 General:

.1 In accordance with manufacturer's recommendations.

.2 Procedures:

.1 Before starting pump, check that cooling water system over-temperature and other protective devices are installed and operative.
.2 After starting pump, check for proper, safe operation.
.3 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.
.4 Check base for free-floating, no obstructions under base.
.5 Run-in pumps for 12 continuous hours minimum.
.6 Verify operation of over-temperature and other protective devices under low- and no-flow condition.
.7 Eliminate air from scroll casing.
.8 Adjust water flow rate through water-cooled bearings.
.9 Adjust flow rate from pump shaft stuffing boxes to manufacturer's recommendation.
.10 Adjust alignment of piping and conduit to ensure true flexibility.
.11 Eliminate cavitation, flashing and air entrainment.
.12 Adjust pump shaft seals, stuffing boxes, glands.
.13 Measure pressure drop across strainer when clean and with flow rates as finally set.
.14 Replace seals if pump used to degrease system or if pump used for temporary heat.

.15 Verify lubricating oil levels.

3.4 COMMISSIONING

.1 Validate alignment, rotation, motor current draw, flows and pressures.

.2 Provide on-site commissioning of Design Envelope Pumps and Pump Manager. Factory trained representative to complete start-up and commissioning for system pumps; Contractor to include for cost as part of pump installation.

3.5 PERFORMANCE VERIFICATION (PV)

.1 Verify that manufacturer's performance curves are accurate.

.2 Ensure valves on pump suction and discharge provide tight shut-off.

.3 Net Positive Suction Head (NPSH):

.1 Application: measure NPSH for pumps which operate on open systems and with water at elevated temperatures.

.2 Where procedures do not exist, discontinue PV, report to Contract Administrator and await instructions.

.4 Multiple Pump Installations - Series and Parallel:

.1 Repeat PV procedures specified above for pump performance and pump BHP for combinations of pump operations.

.5 Mark points of design and actual performance at design conditions as finally set upon completion of TAB.

.6 Commissioning Reports: Reports to include:

.1 Record of point(s) of actual performance at maximum and minimum conditions and for single and parallel operation as finally set at completion of commissioning on pump curves.

.2 Pump performance curves (family of curves).

3.6 CLEANING

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Supply and installation of ductwork, joints and accessories as shown on the drawings.

1.2 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM A480 / A480M, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
.2 ASTM A635 / A635M, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.
.3 ASTM A653 / A653M, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 Department of Justice Canada (Jus).

.1 Canadian Environmental Protection Act (CEPA)

.4 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.5 National Fire Protection Association (NFPA).

.1 NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems.
.2 NFPA 90B, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
.3 NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.6 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible
.2 SMACNA Rectangular Industrial Duct Construction Standard
.3 SMACNA Round Industrial Duct Construction Standard

.7 National Research Council Canada

.1 National Building Code of Canada.
.2 National Energy Code of Canada for Buildings.

.8 Underwriters' Laboratories Inc. (UL)

.1 UL 181, Standard for Factory-Made Air Ducts and Air Connectors

.9 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S110, Fire Tests for Air Ducts

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 21 05 01 – General Provisions – Mechanical.

.2 Product Data:

.1 Indicate:

.1 Thermal properties.

.2 Friction losses.

.3 Acoustical loss.

.4 Leakage.

.5 Fire rating.

1.4 QUALITY ASSURANCE

.1 Certification of Ratings:

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Protect on site stored or installed absorptive material from moisture damage.

.2 Store and manage hazardous materials in accordance with applicable regulations.

Part 2 PRODUCT

2.1 DUCTWORK

.1 Galvanized steel:

.1 Z90 designation zinc coating, lock forming quality: to ASTM A 653/A 653M.
.2 Thickness, fabrication and reinforcement: to SMACNA.
.3 Joints: to SMACNA.

2.2 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows:

.1 Rectangular: smooth radius, centerline radius 1.5 times width of duct.
.2 Round: smooth radius, centerline radius of 1.5 times diameter.

.3 Mitred elbows, rectangular:

.1 To 16" (400 mm): with single thickness turning vanes, 1.5" vane spacing.
.2 Over 16" (400 mm): with double thickness turning vanes, 2.125" vane spacing.
.3 Turning vanes and runners constructed according to SMACNA standards.

.4 Branches:

.1 Rectangular main and branch: with radius on branch 1.5 times width of duct, 45° entry on branch.
.2 Round main and branch: enter main duct to 45° with conical connection.
.3 Provide volume control damper in branch duct near connection to main duct.
.4 Main duct branches: with splitter damper.

.5 Transitions:

.1 Diverging: 20° maximum included angle.
.2 Converging: 30° maximum included angle.

.6 Offsets:

.1 Full radiused elbows.

.7 Obstruction deflectors: maintain full cross-sectional area.

2.3 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	A

.2 Seal classification:

.1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

2.4 SEALANT

.1 Sealant; oil resistant, polymer type fame resistant duct sealant. Temperature range of minus 30° C to plus 93° C.

.2 Acceptable material: Ductmate Proseal/Fibreseal or Approved Equal in accordance with frontend clause B6.

2.5 FLEXIBLE DUCTS

.1 General:

.1 Factory fabricated to CAN/ULC-S110.
.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.
.3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50

.2 Non-Metallic – Uninsulated:

.1 Non-collapsible, coated mineral base fabric type mechanically bonded to, and helically supported by, external steel wire, as indicated.
.2 Performance:

.1 Factory tested to 2.5 kPa without leakage.

.2 Maximum relative pressure drop coefficient: 3.0

.3 Non-Metallic – Insulated:

.1 Non-collapsible, coated mineral base fabric type mechanically bonded to, and helically supported by, external steel wire with factory applied, 1.5" thick flexible mineral fibre thermal insulation with vapour barrier and vinyl jacket, as indicated.
.2 Performance:

.1 Factory tested to 2.5 kPa without leakage.

.2 Maximum relative pressure drop coefficient: 3.0

2.6 FIRE STOPPING

.1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00 Firestopping.

.2 Fire stopping material and installation must not distort duct.

2.7 HANGERS AND SUPPORTS

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.

.1 Maximum size duct supported by strap hanger: 20 in.

.2 Hanger configuration: to SMACNA.

.3 Hangers: galvanized steel angle with galvanized steel rods to SMACNA following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25x25x3	6
751 to 1050	40x40x3	6
1051 to 1500	40x40x3	10
1501 to 2100	50x50x3	10
2101 to 2400	50x50x5	10

2401 and over	50x50x6	10

.4 Upper hanger attachments:

.1 For steel joist: manufactured joist clamp or steel plate washer.
.2 For steel beams: manufactured beam clamps.
.3 For wood framing: 3" (75 mm) long, galvanized lag screws, fastened to structural framing.
.4 For concrete: manufactured concrete inserts.

Part 3 EXECUTION

3.1 GENERAL

.1 Do work in accordance with SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.3 Support risers in accordance with SMACNA as indicated/where applicable.

.4 Install breakaway joints in ductwork on sides of fire separations.

.5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.6 Balancing dampers on all branch supply run-outs.

3.2 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with SMACNA as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1525 and over	2500

3.3 WATERTIGHT DUCT

.1 Provide watertight duct for:

.1 Fresh air intakes.
.2 Exhaust air roof and wall penetrations.
.3 Dishwasher exhaust.
.4 Minimum 10 ft (3000 mm) from duct mounted humidifier in all directions.

.2 Form bottom of horizontal duct without longitudinal seams.

.1 Solder or weld joints of bottom and side sheets.
.2 Seal all other joints with duct sealer.

.3 Slope horizontal branch ductwork down towards hoods served.

.1 Slope header ducts down toward risers.

3.4 STAINLESS STEEL DUCT

.1 Weld all joints of stainless steel ductwork to be airtight in conformance with SMACNA Rectangular Industrial Duct Construction Standards or SMACNA Round Industrial Duct Construction Standards.

3.5 FLEXIBLE DUCTS

.1 Duct Installation:

.1 Install in accordance with NFPA 90A or NFPA 90B.

.2 Locations:

.1 Install flexible duct for each supply air diffuser. Length: 3 – 5 ft.

3.6 KITCHEN EXHAUST SYSTEMS

.1 Install to NFPA 96.

3.7 SEALING AND TAPING

.1 Apply sealant to outside of joint to manufacturer's recommendations.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Materials and Installation for duct accessories including flexible connections, access doors, vane and collars.

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA – HVAC Duct Construction Standards – Metal and Flexible.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet. Indicate the following:

.1 Flexible connections

.2 Duct access doors.

.3 Turning vanes

.4 Instrument test ports

.3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.1 Certification of ratings: catalogue or published rating shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 21 05 01 General Provisions – Mechanical.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

Part 2 PRODUCTS

2.1 GENERAL

.1 Manufacture in accordance with SMACNA – HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.

.2 Material:

.1 Fire resistant, self-extinguishing, neoprene coated glass fabric, temperature rated at -40°C to +90°C, density of 1.3 kg/m^2.

2.3 ACCESS DOORS IN DUCTS

.1 Non-insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.2 Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fiber insulation.

.3 Gaskets: foam rubber.

.4 Hardware:

.1 Up to 300 x 300 mm: 2 sash locks.
.2 301 to 450 mm: 4 sash locks.
.3 451 to 1000 mm: piano hinge and minimum 2 sash locks.
.4 Hold open devices.

.5 Insulated ducts: insulated doors sandwich construction complete with 25 mm thick insulation.

2.4 INSTRUMENT TEST

.1 1.6 mm thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

2.5 SPIN-IN COLLARS

.1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.

.2 Sheet metal thickness to corresponding round duct standards.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations of specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

.1 Flexible connections:

- .1 Install in following locations:
  - .1 Inlets and outlets to all fans.
- .2 Length of connection: 100 mm.
- .3 Minimum distance between metal parts when system in operation: 75 mm.
- .4 Install in accordance with recommendations of SMACNA.
- .5 When fan is running:
  - .1 Ducting on each side of flexible connection to be in alignment.
  - .2 Ensure slack material in flexible connection.

.2 Access doors:

- .1 Size:
  - .1 Minimum 600 x 1800 mm for person size entry.
  - .2 Minimum 305 x 152 mm for servicing entry.
- .2 Location:
  - .1 Fire and smoke dampers
  - .2 At control dampers.
  - .3 At reheat coils (upstream).
  - .4 At devices requiring maintenance.
  - .5 Locations required by code.
  - .6 Elsewhere as indicated.

.3 Instrument Test Ports:

- .1 General:
  - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .2 Locate to permit easy manipulation of instruments.
- .3 Install insulation port extensions as require.
- .4 Locations:
  - .1 For traverse readings:
    - .1 Ducted inlets to roof and wall exhausters.
    - .2 Inlets and outlets of other fan systems.
    - .3 Main and sub-main ducts.

.2 For temperature readings:

.1 At outside air intakes.

.2 In mixed air applications in locations approved by Contract Administrator.

.3 At inlet and outlet of coils.

.4 Downstream of junctions of two converging air streams of different temperatures.

3.3 CLEANING

.1 Perform cleaning operations in accordance with manufacturer's recommendations.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Balancing dampers for mechanical forced air ventilation and air conditioning systems.

1.2 REFERENCES

.1 Sheet Metal and Air Conditioning National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 21 05 01 General Provisions – Mechanical. Include product characteristics, performance criteria, and limitations.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 – Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

Part 2 PRODUCTS

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 SPLITTER DAMPERS

.1 Fabricate from same material as duct but one sheet metal thickness heavier, with appropriate stiffening.

.2 Single thickness construction.

.3 Control rod with locking device and position indicator.

.4 Rod configuration to prevent end from entering duct.

.5 Pivot: piano hinge.

.6 Folded leading edge.

2.3 SINGLE BLADE DAMPERS

.1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.

.2 Size and configuration to recommendations of SMACNA, except maximum height 6 in.

.3 Locking quadrant with shaft extension to accommodate insulation thickness.

.4 Inside and outside bronze end bearings.

.5 Channel frame of same material as adjacent duct, complete with angle stop.

2.4 MULTI-BLADED DAMPERS

.1 Damper frame shall be 16 ga. galvanized steel formed into a 5” x 1” structural hat channel. Top and bottom frame members on dampers less than 17 in. high shall be low profile design to maximize the free area of these smaller dampers. Frame shall be 4-piece construction with 1 ½ in. (minimum) integral overlapping gusset reinforcements in each corner to assure square corners and provide maximum resistance to racking.

.2 Damper blades shall be 16 ga. galvanized steel strengthened by three longitudinal 1” deep V-grooves running the entire length of each blade. Each blade shall be symmetrical relative to its axle pivot point, presenting identical performance characteristics with air flowing in either direction through the damper. Provide symmetrical blades of varying size as required to completely fill the damper opening.

.3 Blade orientation is horizontal. Blade operation is opposed.

.4 Each blade stop (at top and bottom of damper frame) shall occupy no more than ½ in. of the damper opening area to allow for maximum free area and to minimize pressure loss across the damper.

.5 Linkage: concealed in jamb, plated steel material.

.6 Axles: minimum ½” diameter, plated steel.

.7 Axle bearings shall be bronze rotating in polished extruded holes in the damper frame.

.8 Acceptable Product: Greenheck model MBD-15 or Approved Equal in accordance with frontend clause B6.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 Locate balancing dampers in each branch duct for supply, return and exhaust systems.

.4 On main supply duct trunks requiring balancing dampers (where noted on drawings) provide necessary transitions with multi-blade balancing damper.

.5 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.6 All dampers to be vibration free.

.7 Ensure all damper operators are observable and accessible.

.8 Corrections and adjustments conducted by air balancing Contractor.

3.3 CLEANING

.1 Proceed in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Operating dampers for mechanical forced air ventilation and air conditioning systems.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A653 / A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot Dip Process.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATION SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specification and datasheet in accordance with Section 21 05 01 General Provisions – Mechanical. Include product characteristics, performance criteria, and limitations.

.2 Quality assurance submittals: submit following in accordance with Section 21 05 01 General Provisions – Mechanical.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.3 Closeout Submittals

.1 Provide maintenance data for incorporation into manual specified in Section 21 05 01 General Provisions – Mechanical.

1.4 QUALITY ASSURANCE

.1 Certificates:

.1 Catalogued or published ratings those obtained from tests carried out by manufacturer from independent testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

Part 2 PRODUCTS

2.1 MOTORIZED DAMPER, INSULATED

.1 Extruded aluminum damper frame shall not be less than 0.080” (2.03 mm) in thickness. Damper frame shall be 4” (101.6 mm) deep x 1" (25.4 mm), with duct mounting flanges on both sides of frame. Frame to be assembled using zinc-plated steel mounting fasteners. Welded frames shall not be acceptable.

.2 Entire frame shall be thermally broken by means of polyurethane resin pockets complete with thermal cuts.

.3 Blades shall be maximum 6" (152.4 mm) deep extruded aluminum (6063-T5) air-foil profiles with a minimum wall thickness of 0.06” (1.52mm). Blades shall be internally insulated with expanded polyurethane foam and shall be thermally broken. Complete blade shall have an insulating factor of R-2.29. All blades shall be symmetrically pivoted.

.4 Blade seals shall be extruded silicone, secured in an integral slot within the aluminum blade extrusions and shall be mechanically fastened to prevent shrinkage and movement over the life of the damper. Adhesive or clip-on type blade seals will not be approved.

.5 Frame seals shall be extruded silicone, secured in an integral slot within the aluminum frame extrusions and shall be mechanically fastened to prevent shrinkage and movement over the life of the damper. Metallic compression type jamb seals will not be approved.

.6 Bearings shall be a dual bearing system composed of a Celcon inner bearing (fixed around a 7/16" (11.11 mm) aluminum hexagon blade pivot pin), rotating within a polycarbonate outer bearing inserted in the frame. Single axle bearing, rotating in an extruded or punched hole shall not be acceptable.

.7 Hexagonal control shaft shall be 7/16" (11.11 mm). It shall have an adjustable length and shall be an integral part of the blade axle. A field-applied control shaft shall not be acceptable. All parts shall be zinc-plated steel.

.8 Linkage hardware shall be aluminum and corrosion-resistant zinc-plated steel, installed in the frame side, out of the airstream, and accessible after installation. Linkage hardware shall be complete with cup-point trunnion screws to prevent linkage slippage and a Celcon bearing between moving parts to reduce wear and increase longevity. Linkage that consists of metal rubbing metal will not be approved.

.9 Dampers shall be designed for operation in temperatures ranging from -40°F (-40°C) to 212°F (100°C).

.10 Dampers shall be AMCA rated for Leakage Class 1A at 1 in w.g. (0.25 kPa) static pressure differential. Standard air leakage data to be certified under the AMCA Certified Ratings Program.

.11 Dampers shall be custom made to required size, with blade stops not exceeding 1¼" (31.7 mm) in height. The blade stop shall be a continuous and integral part of the head/sill. Welded and caulked blade stops shall not be acceptable.

.12 Damper Blade Action:

.1 Opposed blade action for mixing or modulating applications.
.2 Parallel blade action for two position (open, closed) applications.

.13 Dampers shall be Flanged to Duct install type only.

.14 Installation of dampers must be in accordance with manufacturer's instructions.

.15 Field-supplied intermediate structural support is required to resist applied pressure loads for dampers that consist of two or more sections in both height and width. Refer to manufacturer's guidelines.

.16 Acceptable Product: TAMCO Series 9000 BF or Approved Equal in accordance with frontend clause B6.

2.2 MOTORIZED DAMPER, UN-INSULATED

.1 Extruded aluminum damper frame shall not be less than 0.080" (2.03 mm) in thickness. Damper frame shall be 4" (101.6 mm) deep x 1" (25.4 mm), with duct mounting flanges on both sides of frame. Damper frame shall have a 2" (50.8 mm) mounting flange on the rear of the damper, when installed as Extended Rear Flange install type. Frame to be assembled using zinc-plated steel mounting fasteners. Welded frames shall not be acceptable.

.2 Blades shall be maximum 6.4" (162.6 mm) deep extruded aluminum air-foil profiles with a minimum wall thickness of 0.06" (1.52mm). All blades shall be symmetrically pivoted.

.3 Blade seals shall be extruded EPDM, secured in an integral slot within the aluminum blade extrusions and shall be mechanically fastened to prevent shrinkage and movement over the life of the damper. Adhesive or clip-on type blade seals will not be approved.

.4 Frame seals shall be extruded silicone, secured in an integral slot within the aluminum frame extrusions and shall be mechanically fastened to prevent shrinkage and movement over the life of the damper. Metallic compression type jamb seals will not be approved.

.5 Bearings shall be a dual bearing system composed of a Celcon inner bearing (fixed around a 7/16" (11.11 mm) aluminum hexagon blade pivot pin), rotating within a polycarbonate outer bearing inserted in the frame. Single axle bearing, rotating in an extruded or punched hole shall not be acceptable. Bearings are to be maintenance-free, requiring no lubrication.

.6 Hexagonal control shaft shall be 7/16" (11.11 mm). It shall have an adjustable length and shall be an integral part of the blade axle. A field-applied control shaft shall not be acceptable. All parts shall be zinc-plated steel.

.7 Linkage hardware shall be aluminum and corrosion-resistant zinc-plated steel, installed in the frame side, out of the airstream, and accessible after installation. Linkage hardware shall be complete with cup-point trunnion screws to prevent linkage slippage and a Celcon bearing between moving parts to reduce wear and increase longevity. Linkage that consists of metal rubbing metal will not be approved.

.8 Dampers shall be designed for operation in temperatures ranging from -40°F (-40°C) to 212°F (100°C).

.9 Dampers shall be AMCA rated for Leakage Class 1A at 1 in. w.g. (0.25 kPa) static pressure differential. Standard air leakage data to be certified under the AMCA Certified Ratings Program.

.10 Dampers shall be custom made to required size, with blade stops not exceeding 1¼" (31.7 mm) in height. The blade stop shall be a continuous and integral part of the head/sill. Welded and caulked blade stops shall not be acceptable.

.11 Damper Blade Action:

.1 Opposed blade action for mixing or modulating applications.
.2 Parallel blade action for two position (open, closed) applications.

.12 Dampers shall be installed in the following manner: Flanged to Duct.

.13 Installation of dampers must be in accordance with manufacturer's instructions.

.14 Field-supplied intermediate structural support is required to resist applied pressure loads for dampers that consist of two or more sections in both height and width. Refer to manufacturer's guidelines.

.15 Acceptable Product: TAMCO Series 1000 or Approved Equal in accordance with frontend clause B6.

2.3 BACKDRAFT DAMPER

.1 Performance:

.1 Dampers shall have a maximum leakage of 10 cfm @ 1 in. wg. Tested in accordance with AMCA standard 500-D.
.2 Dampers shall have a maximum pressure drop of 0.25 in. wg in accordance with AMCA Figure 5.3, blades fully open without weights.
.3 Dampers shall have a maximum differential pressure rating of 4 in. wg.
.4 Dampers shall have a maximum velocity rating of 3500 fpm (18 m/s).

.2 Damper frame shall be .125" extruded aluminum frame with screwed corners. Blade orientation is horizontal.

.3 Blades: Damper blades shall be .070 in. extruded aluminum.

.4 Blade seals shall be Vinyl, which are mechanically fastened to each blade.

.5 Linkage: On blade, plated steel material.

.6 Aluminum axles.

.7 Axle bearings shall be synthetic (acetal) sleeve.

.8 Mil finish.

.9 Acceptable Product: Greenheck EM-30 series or Approved Equal in accordance with frontend clause B6.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 Seal multiple damper modules with silicon sealant.

.4 Install access door adjacent to each damper. See Section 23 33 00 – Air Duct Accessories.

.5 Ensure dampers are observable and accessible.

3.3 CLEANING

.1 Proceed in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Fire and smoke dampers, and fire stop flaps.

1.2 REFERENCES

.1 American National Standards Institute (ANSI) / National Fire Protection Association (NFPA)

.1 ANSI/NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating System.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S112, Standard Method of Fire Test of Fire Damper Assemblies
.2 CAN/ULC-S112.1, Standard for Leakage Rated Dampers for Use in Smoke Control Systems
.3 CAN/ULC-S112.2, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies
.4 ULC-S505, Fusible Links for Fire Protection Service.

1.3 ACTION AND INFORMATION SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 21 05 01 General Provisions – Mechanical.
.2 Indicate the following:
.1 Fire dampers.
.2 Smoke dampers.
.3 Fire stop flaps.
.4 Operators.
.5 Fusible links.
.6 Design details of break-away joints.

.2 Quality assurance submittals: submit following in accordance with Section 21 05 01 General Provisions – Mechanical.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.3 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 21 05 01 General Provisions – Mechanical.

1.4 QUALITY ASSURANCE

.1 Certificates:

.1 Catalogue or published ratings those obtained from tests carried out by manufacturer of those ordered by manufacturer from independent testing agency signifying adherence to codes and standards,

1.5 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in Section 21 05 01 General Provisions – Mechanical.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

Part 2 PRODUCTS

2.1 FIRE DAMPERS, FD

.1 Fire dampers shall meet all N.B.C. requirements for fire dampers and be constructed in accordance with NFPA Standard No. 90A. Fire dampers and fusible links shall be tested and approved by ULC or another nationally recognized testing agency acceptable to the Authority Having Jurisdiction and bear the appropriate label. Fire damper assemblies fire tested in accordance with CAN/ULC-S112.

.2 Fire dampers shall be of interlocking blade design. Use fire dampers with blades in the air stream (Type A) for velocities 8 m/s (1000 fpm) and lower where aspect ratio is 2:1 or less. Use low resistance type fire dampers with blades out of the air stream (Type B) for velocities above 8 m/s (1000 fpm) and aspect ratios greater than 2:1. Use (Type C) type fire dampers for round duct penetrations through fire separations.

.3 Generally, use fusible links at 70°C (160°F) on exhaust and recirculation ducts, 105°C (220°F) on supply ducts and kitchen exhaust ducts. Revise, with Engineer's approval, as required to meet the needs of special locations. Fusible links shall be readily removable by hand to facilitate testing. All dampers to be factory tested for proper operation.

.4 Fire dampers shall have dynamic rating suitable for maximum air velocity and pressure differential to which it will be subjected.

.5 Acceptable Manufacturer: Greenheck, Nailor, Price, Ruskin.

2.2 COMBINATION FIRE & SMOKE DAMPERS , FSD

.1 Fire Resistance Rating:

.1 To suit the separation resistance rating. Refer to Architectural.

.2 Fire Closure Temperature:

.1 Each combination fire-smoke damper shall be equipped with a factory installed heat responsive device rated to close the damper when the temperature at the damper reaches 74°C (165°F) on exhaust and recirculation ducts, 100°C (212°F) on supply ducts and kitchen exhaust ducts. Revise, with Engineer's approval, as required to meet the needs of special locations.

.2 Fusible links shall be readily removable by hand to facilitate testing.

.3 All dampers to be factory tested for proper operation.

.3 Elevated Operational Temperature:

.1 Dampers shall have a UL 555S elevated temperature rating of 121°C (250°F).

.4 Leakage:

.1 Dampers shall have a UL555S leakage rating of Leakage Class I (8 cfm/ft2 (0.04 m3/ s/m2) at 4 in. wg (1.0 kPa).

.5 Differential Pressure:

.1 Dampers shall have a UL 555S differential pressure rating of 4 in. wg.

.6 Velocity: Dampers shall have a UL 555S velocity rating of 2000 fpm.

.7 Performance:

.1 The damper manufacturer's submittal data shall certify that all pressure drop data is licensed in accordance with the AMCA Certified Ratings Program for Test Figures 5.2, 5.3, and 5.5. Damper air performance data shall be developed in accordance with the latest edition of AMCA Standard 500-D. Dampers shall be labeled with the AMCA Air Performance Seal. AMCA certified pressure drop for a 24 in. wide x 24 in. high damper shall not exceed 0.09 in. wg when subjected to an airflow velocity of 1500 fpm according to AMCA Test Figure 5.3

.8 Construction:

.1 Blades:

.1 Each blade shall be symmetrical relative to its axle pivot point, presenting identical performance characteristics with air flowing in either direction through the damper.

.2 Provide symmetrical blades of varying size as required to completely fill the damper opening.

.2 Linkage:

.1 Blade linkages shall be non-adjustable and concealed within the jamb of the damper.

.3 Sleeves:

.1 Damper shall be supplied as a single assembly with a factory installed sleeve made of material matching that of the damper.

.4 Fire Closure Device:

.1 Damper shall be supplied with a fusible link.

.5 Mounting:

.1 Horizontal

.6 Finish:

.1 Galvanized Steel

.9 Actuator Type and Voltage:

.1 Electric, 120V AC, position.

.10 Acceptable Manufacturer:

.1 Greenheck, Nailor, Price, Ruskin, Titus or Approved Equal in accordance with frontend clause B6.

Part 3 EXECUTION

3.1 GENERAL

.1 Supply and installation of fire and smoke dampers shall be in strict accordance with applicable codes, regulations and Authorities Having Jurisdiction.

.2 Refer to Architectural Drawings to determine all fire separations. Provide dampers at all duct penetrations. Ensure no exits are penetrated by ducts. Check for fire rated enclosures around combustion air, drier exhaust and ducts through exits. Review all dampers and separations with the Contract Administrator early in the project.

.3 Complete installation, testing and submit fire damper inspection report with all tests successful; before substantial completion/occupancy.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.3 INSTALLATION

.1 Install all dampers in strict accordance with ANSI/NFPA 90A, their ULC listings and the manufacturer's recommendations. Install dampers only in positions for which they have been listed.

.2 Maintain integrity of fire separation.

.3 Install break-away joints of approved design on each side of fire separation.

.4 Meet with TAB Contractor early in the project to review all locations and ensure complete testing and report.

.5 Provide access doors to all fusible links, damper operators and linkages to facilitate testing and maintenance. See Section 23 33 00 Air Duct Accessories.

.6 Identify all dampers clearly and accurately on the as-built drawings.

3.4 CLEANING

.1 Proceed in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Fans, motors, accessories and hardware for commercial use.

1.2 REFERENCES

.1 Air Conditioning and Mechanical Subcontractors (AMCA)

.1 AMCA Publication 99, Standards Handbook.
.2 AMCA 300, Reverberant Room Method for Sound Testing of Fans.
.3 AMCA 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.2 American National Standards Institute (ANSI) / American Society of Mechanical Engineers (ASME)

.1 ANSI/AMCA 210, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.3 National Fire Prevention Association (NFPA)

.1 NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.181, Ready-Mixed Organic Zinc-Rich Coating.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.
.2 Capacity: flow rate, static pressure, BHP (W), efficiency, RPM, power, model size, sound power data and as indicated on schedule.
.3 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.
.4 Sound Ratings: comply with AMCA 301, tested to AMCA 300. Supply unit with AMCA certified sound rating seal.

.5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210. Supply unit with AMCA certified rating seal, except for propeller fans smaller than 12" diameter.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 21 05 01 General Provisions – Mechanical. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:

.1 Submit shop drawings and product data in accordance with Section 21 05 01 – General Provisions - Mechanical.

.3 Provide:

.1 Fan performance curves showing point of operation, and efficiency.
.2 Sound rating data at point of operation.

.4 Indicate:

.1 Motors, sheaves, bearings, wheels, shaft details and accessories.
.2 Minimum performance achievable with variable speed controllers, when necessary.

.5 Quality assurance submittals: submit following in accordance with Section 01 33 00 – Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
.2 Instructions: submit manufacturer's installation instructions.

.6 Closeout Submittals:

.1 Provide operation and maintenance data for incorporation into manual specified in Section 21 05 01 General Provisions – Mechanical.

1.5 MAINTENANCE

.1 Furnish list of individual manufacturer's recommended spare parts for equipment, include:

.1 Bearings and seals.
.2 Matched set of belts.
.3 Addresses of suppliers.
.4 List of specialized tools necessary for adjusting, repairing or replacing.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions

Part 2 PRODUCTS

2.1 SMUDGING EXHAUST FAN, EF-1

.1 General Description:

- .1 Discharge air directly away from the mounting surface.
- .2 Upblast fan shall be for roof mounted applications for fan sizes 060-300 or wall mounted applications for fan sizes 060-200.
- .3 Performance capabilities up to 14,700 cubic feet per minute (cfm) and static pressure to 3 inches of water gauge.
- .4 Fans are available in fifteen sizes with nominal wheel diameters ranging from 8 inches through 30 inches (060 - 300 unit sizes).
- .5 Maximum continuous operating temperature for fan sizes 098-200 is 400 Fahrenheit (204.4 Celsius) and for fan sizes 060-095 is 130 Fahrenheit (54.4 Celsius)
- .6 Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number

.2 Wheel:

- .1 Material Type: Aluminum
- .2 Non-overloading, backward inclined centrifugal wheel
- .3 Statically and dynamically balanced in accordance to AMCA Standard 204-05
- .4 The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency

.3 Motors:

- .1 Electronically Commutated Motor
  - .1 Motor enclosure: Open drip proof
  - .2 Motor to be a DC electronic commutation type motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable. Examples of unacceptable motors are: Shaded Pole, Permanent Split Capacitor (PSC), Split Phase, Capacitor Start and 3 phase induction type motors
  - .3 Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase
  - .4 Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor

.5 Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal

.6 Motor shall be a minimum of 85% efficient at all speeds

.4 Housing:

.1 Constructed of heavy gauge aluminum includes exterior housing, curb cap, windband, and motor compartment housing. Galvanized material is not acceptable
.2 Housing shall have a rigid internal support structure
.3 Windband to be one piece uniquely spun aluminum construction and maintain original material thickness throughout the housing
.4 Windband to include an integral rolled bead for strength
.5 Curb cap base to be fully welded to windband to ensure a leak proof construction. Tack welding, bolting, and caulking are not acceptable
.6 Curb cap to have an integral deep spun inlet venturi and pre-punched mounting holes to ensure correct attachment to curb
.7 Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators
.8 Breather tube shall be 10 square inches in size for fresh air motor cooling, and designed to allow wiring to be run through it

.5 Motor Cover:

.1 Constructed of aluminum

.6 Vibration Isolation:

.1 Double studded or pedestal style true isolators
.2 No metal to metal contact
.3 Sized to match the weight of each fan

.7 Disconnect Switches:

.1 NEMA rated: NEMA 4X: same as NEMA 4, but corrosion resistant.
.2 Positive electrical shut-off
.3 Wired from fan motor to junction box installed within motor compartment

.8 Drain Trough:

.1 Allows for one-point drainage of water, grease, and other residues

.9 Options/Accessories:

.1 Birdscreen:

.1 Material Type: Stainless Steel

.2 Protects fan discharge

.2 Roof Curbs:

.1 Type: GPR

.2 Mounted onto roof with fan

.3 Material: Aluminum

.4 Insulation thickness: 1 inch

.5 Height: 16”

.3 Curb Extension:

.1 Type: GPEX - Curb extension without access door or damper tray

.2 Material Type: Galvanized

.3 Height: 12”

.4 Dampers:

.1 Type: WD-100, Gravity

.2 Prevents outside air from entering back into the building when fan is off

.3 Balanced for minimal resistance to flow

.4 Galvanized frames with prepunched mounting holes

.10 Performance:

.1 Refer to Schedule on drawings.

.11 Acceptable Product:

.1 Greenheck CUE-099-VG or Approved Equal in accordance with frontend clause B6.

Part 3 EXECUTION

3.1 MANUFACTURER’S INSTRUCTIONS

.1 Compliance: comply with manufacturer’s written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 FAN INSTALLATION

.1 Install fans as indicated, according to manufacturer’s instructions.

.2 Install flexible connections in accordance with Section 23 33 00 Air Duct Accessories.

.3 Provide sheaves and belts required for final air balance.

.4 Bearings and extension tubes to be easily accessible.

.5 Exhaust fans with speed controls to be wired by electrical.

.6 Kitchen exhaust fans: Install fans in accordance with NFPA 96 requirements.

.7 Access doors and access panels to be easily accessible.

3.3 CLEANING

.1 Proceed in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Supply, return and exhaust grilles and registers, diffusers and linear grilles, for commercial use.

1.2 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer from independent testing agency signifying adherence to codes and standards.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit product data in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Indicate the following:

.1 Capacity.

.2 Throw and terminal velocity.

.3 Noise criteria.

.4 Pressure drop.

.5 Neck velocity.

.2 Quality assurance submittals:

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards

.3 Instructions: submit manufacturer's installation instructions.

.3 Closeout Documentation:

.1 Provide maintenance data for incorporation into manual specified in Section 21 05 01 General Provisions – Mechanical

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

Part 2 PRODUCTS

2.1 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity.

.2 Frames:

- .1 Full perimeter gaskets.
- .2 Plaster frames where set into plaster or gypsum board at all locations and as specified.
- .3 Concealed fasteners.

.3 Concealed manual volume control damper operators when dampers are specified for grilles, registers and diffusers.

.4 Colour: Allow for premium colour / finish, selected by Contract Administrator.

2.2 MANUFACTURED ITEMS

.1 Grilles, registers and diffusers of same generic type to be product of one manufacturer.

2.3 GRILLES, REGISTERS AND DIFFUSERS

.1 Refer to drawings for grille and diffuser sizes and performance schedules.

.2 Acceptable Manufacturers: Price, Nailor, Titus or Approved Equal in accordance with frontend clause B6.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Install with stainless steel screws in countersunk holes where fastenings are visible.

.3 Bolt grilles, registers and diffusers, in place, in gymnasiums and similar game rooms.

.4 Provide concealed safety chain on each grille, register and diffuser in gymnasiums and similar game rooms, or elsewhere as indicated.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Mechanical louvers, intakes, vents and reinforcement and bracing for air vents, intakes and gooseneck hoods.

1.2 REFERENCES

.1 American National Standards Institute (ANSI) / National Fire Protection Association (NFPA)

.1 ANSI/NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.2 American Society for Testing and Materials International (ASTM),

.1 ASTM E 90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS)

.4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 21 05 01 General Provisions – Mechanical. Include product characteristics, performance criteria, and limitations.

.2 Indicate following:

.1 Pressure drop.

.2 Face area.

.3 Free area.

.2 Quality assurance submittals: submit following in accordance with Section 21 05 01 General Provisions – Mechanical.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
.2 Instructions: submit manufacturer's installation instructions

.3 Test Reports:

.1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

Part 2 PRODUCTS

2.1 LOUVERS

.1 Refer to drawings for louver sizes and performance schedules.

.2 Colour: Allow for premium finish/colour, selected by Contract Administrator.

.3 Acceptable Manufacturers: Price, Ruskin, or Approved Equal in accordance with frontend clause B6.

2.2 GOOSENECK HOODS

.1 Thickness: to SMACNA.

.1 Kitchen: to ANSI/NFPA 96
.2 Elsewhere: to SMACNA.

.2 Fabrication: to SMACNA.

.1 Kitchen: to ANSI/NFPA 96
.2 Elsewhere: to SMACNA.

.3 Joints: to SMACNA or proprietary manufactured duct joint. Proprietary manufactured flanged duct joint shall be considered to be a class A seal.

.4 Supports: as indicated.

.5 Complete with integral birdscreen of 2.7 mm diameter stainless steel wire. Use 12 mm mesh on exhaust, 19 mm mesh on intake.

2.3 WALL CAP TERMINATIONS

.1 Size: to suit existing or new ductwork.

.2 Exhaust Terminations:

.1 Construction: 22-gauge steel.
.2 Finish: Galvanized.
.3 Spring loaded backdraft damper and bird screen.
.4 Attachment collar to connect to new/existing ductwork.

.3 Intake Terminations:

.1 Construction: 22-gauge steel.
.2 Finish: Galvanized.
.3 Mesh screen without backdraft damper.
.4 Attachment collar to connect to new/existing ductwork.

.4 Acceptable Manufacturer: Broan or Approved Equal in accordance with frontend clause B6.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation and instructions, and datasheet.

3.2 INSTALLATION

.1 In accordance with manufacturers and SMACNA recommendations.

.2 Reinforce and brace air vents, intakes and goosenecks as indicated.

.3 Anchor securely into opening. Seal with caulking all around to ensure weather tightness.

3.3 CLEANING

.1 Proceed in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Materials, accessories and installation for breechings, chimneys and stacks.

1.2 REFERENCES

.1 Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

.2 National Fire Protection Association (NFPA)

.1 NFPA 211, Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances.

.3 Canadian Standards Association (CSA)

.4 Underwriters' Laboratories of Canada (ULC)

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 21 05 01 General Provisions – Mechanical. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:

.1 Submit drawings stamped and signed by professional Contract Administrator registered or licensed in Province of Manitoba, Canada. Provide calculations demonstrating adequate venting for all operating conditions of appliances to be installed.

.2 Submit shop drawings in accordance with Section 21 05 01 General Provisions – Mechanical.

.1 Indicate following:

.1 Methods of sealing sections.

.2 Methods of expansion.

.3 Details of thimbles.

.4 Bases/Foundations.

.5 Supports.

.6 Guy wire details.

.7 Velocity cones.

.3 Quality assurance submittals: submit following in accordance with Section 01 00 00 – General Requirements.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Closeout Submittals

.1 Submit operation and maintenance data for incorporation into manual specified in Section 21 05 01 General Provisions – Mechanical.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements: work to be performed in compliance with applicable Provincial OFC-ITSM regulations.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with legislated Health and Safety Requirements.

.3 Certificates:

.1 Catalogued or published ratings: obtained from tests carried out by independent testing agency or manufacturer signifying adherence to codes and standards.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle in accordance with manufacturer's written instructions.

Part 2 PRODUCTS

2.1 FUELS: PRESSURE CHIMNEY AND BREECHING

.1 The factory built breeching system shall be made in accordance with NFPA 211. This stack system shall be designed and installed to be gas tight. it shall be UL Listed to withstand up to 5kPa (20 in w.c.) positive pressure. This breeching system shall be designed to compensate for all flue gas induced thermal expansions. Air gap between inner and outer pipe shall be 1 in thick. Clearances to combustible materials shall be per installation instructions.

.2 The joint assembly shall be male/female slip-type jointing with flange to flange and V-band assembly. An internal sleeve serves for readily alignment as well as long term joint seal protection from condensate, water and flue gas temperature. Non-slip type joints are not acceptable.

.3 The double wall stack has an inner gas carrying pipe of 24 gauge type AL29-4C stainless steel. The outer jacket shall be 24 gauge, 430 stainless steel. The materials and construction of the modular sections and accessories shall be as specified by the terms of the products UL listing.

.4 The entire stack system from each boiler to the termination, including accessories, shall be from one manufacturer.

.5 The breeching and stack shall be warranted against functional failure due to defects in material and manufacturer's workmanship for a period of 10 years from the date of delivery.

.6 Drawings showing the actual layout which drawn to scale shall be provided by the manufacturer. The system shall be installed as designed by the manufacturer and in accordance with the terms of the manufacturer's 10-year warranty and in conjunction with sound engineering practice.

.7 The inner diameter for breeching and stack shall be verified by the manufacturer's computations. The computation shall be technically sound, shall follow ASHRAE calculation methods and incorporate the specific flow characteristics of the inner pipe.

.8 Technical services supports; the factory built modular stack system shall be furnished by a vendor organization which assures design, installations and services coordination and provides in-warranty and post warranty unified responsibility for The City.

.9 Approved Product: Selkirk model Saf-T Vent CI Plus or Approved Equal in accordance with frontend clause B6. Polypropylene venting is considered equal provided the boiler is rated for its use.

2.2 ACCESSORIES

.1 Cleanouts: bolted, gasketed type, full size of prefabricated sections and as indicated.

.2 Transition fittings to suit connection to boiler flue outlet.

.3 Hangers and supports: in accordance with manufacturer’s recommendations, recommendations of Sheet Metal and Air Conditioning Contractors National Association Inc. (SMACNA) and as indicated.

.4 Velocity cone vent termination.

.5 Inspection tees as required by the Authority Having Jurisdiction (AHJ).

.6 Expansion sleeves with heat resistant caulking, held in place as indicated.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION - GENERAL

.1 Follow manufacturer's and SMACNA installation recommendations for shop fabricated components.

.2 Ensure components have identification symbols visible for AHJ inspection.

.3 Ensure components are orientated in the correct direction of flue-gas flow.

.4 Suspend breeching at 5 ft centres and at each joint.

.5 Support chimneys at bottom, roof and intermediate levels as indicated.

.6 Install thimbles where penetrating roof, floor, ceiling and where breeching enters masonry chimney. Pack annular space with heat resistant caulking.

.7 Install flashings on chimneys penetrating roofs, as indicated.

.8 Install chimney terminations and cleanouts, as indicated.

3.3 CLEANING

.1 Proceed in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Heating boiler units:

.1 Fire tube.
.2 Cast iron.
.3 Coil tube hot water.
.4 Electric.
.5 Gas and oil burners.
.6 Installation.
.7 Commissioning.

1.2 REFERENCES

.1 American Boiler Manufacturer's Association (ABMA)

.2 American National Standards Institute (ANSI) / Canadian Standards Association (CSA)

.1 ANSI Z21.13 / CSA 4.9, Gas-Fired Low-Pressure Steam and Hot Water Boilers

.3 American National Standards Institute (ANSI) / American Society of Mechanical Engineers (ASME)

.1 Boiler and Pressure Vessel Code, Section IV
.2 ANSI B31.1 Power Piping Code

.4 Canadian Gas Association (CGA)

.1 CAN1-3.1, Industrial and Commercial Gas-Fired Package Boilers

.5 Canadian Standards Association (CSA)

.1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code
.2 CSA B139, Installation Code for Oil Burning Equipment
.3 CSA B140.7, Oil Burning Equipment: Steam and Hot-Water Boilers
.4 CSA C22.1, Canadian Electrical Code

.6 Canadian Standards Association (CSA) / Canadian Gas Association (CGA)

.1 CAN/CGA B149.1, Natural Gas and Propane Installation Code.

.7 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturers printed product literature, specifications and datasheet in accordance with Section 21 05 01 General Provisions – Mechanical. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Indicate the following:

.1 General arrangement showing terminal points, instrumentation test connections.

.2 Clearances for operation, maintenance, servicing, cast iron section cleaning, cast iron section replacement.

.3 Foundations with loading, anchor bolt arrangement.

.4 Piping hook-ups.

.5 Equipment electrical drawings.

.6 Burners and controls.

.7 All miscellaneous equipment.

.8 Flame safety control system.

.9 Breaching and stack configuration.

.3 Engineering data to include:

.1 Boiler efficiency at 25%, 50%, 75%, 100% and 110% of design capacity.

.2 Radiant heat loss at 100% design capacity.

.3 Quality assurance submittals: submit following in accordance with Section 01 33 00 Submittal Procedures:

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.4 Closeout Submittals:

.1 Submit operation and maintenance data for incorporation into manual specified in Section 21 05 01 General Provisions – Mechanical.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements: work to be performed in compliance with applicable Provincial OFC-ITSM regulations.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Contractors COR Safety Plan and The City's Health and Safety Requirements.

1.5 EQUIPMENT SPECIFIC WARRANTY

.1 General Warranty

.1 Installing Contractor shall provide one year of warranty parts and labour

.2 Heat exchanger

.1 Warranty Period: Manufacturer's standard, but not less than 10 years from date of Substantial Completion on the heat exchanger.

.3 A Warranty Certificate must be issued to The City from the manufacturer and a copy of warranty must be submitted for engineer's approval.

Part 2 PRODUCTS

2.1 ELECTRIC BOILER, B-01

.1 GENERAL

.1 Description:

.1 Each unit shall be a complete boiler with automatic controls. The boiler, with all piping and wiring, shall be a factory package. Each boiler shall be neatly finished, thoroughly tested and properly packaged for shipping. Boiler design and construction shall be in accordance with Section IV of the ASME Code for hot water heating boilers with a maximum working pressure of 160 PSIG.

.2 Pressure Vessel:

.1 Vertical carbon steel with welded heads and flanged element insertion openings.

.2 The boiler shall have one supply connection and one return water connection. The supply and return connections shall be positioned so that water flow cannot short circuit heating elements.

.3 Casing:

.1 Jacket: 18 gauge metal wrapped casing.

.4 Control compartment enclosures: NEMA 250, Type 1A.

.5 Finish: Enamel.

.6 Insulation:

.1 Minimum two (2) inch thick, mineral-fiber insulation having minimum 1-1/2 lbft3 density surrounding the heat exchanger. Radiation and convection losses shall not exceed 0.5% of total boiler output.

.2 HEATING ELEMENTS

.1 The heating elements shall be individually field replaceable with standard tools.

.1 Heating elements shall be mounted on circular flanges for convenient inspection.

.2 Heating elements shall be secured using torqued ferrule fittings.

.2 The heating elements watt density shall not exceed 75 watts per square inch.

.3 The heating elements shall be Incoloy 800 sheathed.

.4 The heating elements length shall not exceed 36 inches.

.3 TRIM

.1 Safety valve(s) shall be ASME Section IV approved side outlet type. Size shall be in accordance with code requirements and set to open at specified pressure or maximum allowable boiler pressure.

.2 Pressure gauge.

.3 Thermometer.

.4 Solid state low water cut-off probe control with manual reset and test switch.

.5 Status lights for power on, high temperature cutoff, low water cutoff, step status for each step.

.6 Automatic air vent

.7 Auxiliary low water cutoff

.8 Alarm horn (electronic sounder)

.9 Automatic isolation valves

.4 CONTROLS

.1 All controls to be panel mounted and located on the boiler as to provide ease of servicing the boiler without disturbing the controls and also located to prevent possible damage by water according to UL and CSA requirements.

.2 When multiple boilers are to be installed together, a system integration control shall be provided to stage up to four (4) boilers using a separate boiler lead-lag panel.

.3 The control shall include automatic selection of needed boilers based on load demand. The control shall monitor supply water heater temperature, return water temperature to each boiler, and shall communicate to boilers using a 4-20mA analog signal.

.4 Boilers controls shall communicate with BACnet I or P Johnson Metasys N2, refer to Controls Contractor, building management system utilizing a protocol translator for requirements other than the native ModBus RTU.

.1 Protocol translator mounted in a NEMA 1 panel with power supply and terminals.

.2 Protocol translator shipped loose for installation in boiler control panel with required power supply.

.5 The boiler controls shall include provisions for remote setpoint.
.6 Include provisions for shutting down the boiler on loss of system pump signal.
.7 Include a flow switch and provisions for shutting down the boiler on loss of flow.
.1 Mount flow switch to the boiler return nozzle
.8 Step control capabilities shall include:
.1 3-Steps+: (1) solid state electronic proportional temperature control with progressive step control, adjustable span, and interstage time delay.
.1 Temperature and set-point temperature shall be displayed at all times. A supply water temperature transmitter shall be provided and wired to the PID process controller.
.2 Control shall be equipped with a touchscreen display for set up, trouble shooting, and operational display, and shall include ModBus communication capability.
.3 Control shall include the programming to control of up to two heating demand loops.
.4 Set-points and configurations shall be factory pre-configured. Parameter settings are to be established to suit jobsite conditions and to be configured at the time of initial jobsite operation.
.2 Silicon controlled rectifier (SCR) control

.5 ELECTRICAL POWER

.1 Electrical power supply shall be 600 volts, 60 cycle three phase.
.2 Main lugs for supply circuits.
.1 Mechanical lugs bolted to copper bus bars or distributions blocks with pressure connectors.
.2 Panel electrical short circuit current rating (SCCR) shall be 10,000 amps interrupting current. Higher SCCR ratings are available upon request.
.3 Fused 120V control circuit transformer.
.4 Supplemental internal branch circuit fuses, current limiting, non-renewable, rated at 200,000 amps interrupting capacity.
.5 Magnetic contactors rated at 500,000 cycles, 50A resistive up to 600V.
.6 Housed in NEMA 250, Type 1A enclosure with louvers.
.7 Wiring shall be numbered and color coded to match a wiring diagram.
.1 Install factory wiring outside of an enclosure in a metal raceway or conduit.
.2 Minimum heating element wire size shall be #8 AWG.
.3 Minimum control circuit wire size shall be #16 AWG.

.8 Field power interface shall be to fused disconnect switch or molded case magnetic circuit breaker.

.1 Disconnect shall be through the door type and mounted directly to boiler main electrical cabinet.

.2 Disconnect shall be shipped loose for installation by Contractor.

.3 Ground fault current interrupting (GFCI) circuit breaker

.4 Panel mounted power meter to measure and display input voltage, amperage, and/or power.

.1 Data Logging:

.1 Totalized power consumption (kWh)

.2 Real-time clock

.3 Limit alarms

.9 Communications over Ethernet.

.6 QUALITY CONTROL

.1 Hydrostatic Test: Factory to perform a functional controls test for all safety devices; perform hydrostatic test; and continuity test for contactors and relays.

.2 Test and inspect factory-assembled boilers, before shipping, according to most current ASME Boiler and Pressure Vessel Code.

.3 All wiring shall be in compliance with the National Electric Code.

.7 PERFORMANCE

.1 Refer to Schedule on drawings.

.8 ACCEPTABLE PRODUCT

.1 Cleaver Brooks WB-241 or Approved Equal in accordance with frontend clause B6.

2.2 CONDENSING BOILERS, B-02

.1 HIGH MASS FIRETUBE STAINLESS STEEL CONDENSING BOILERS

.1 "Near condensing" copper fin designs, watertube, cast iron, cast aluminum, or "add-on" secondary condensing exchangers will not be considered. Boilers with minimum flow requirements also will not be considered.

.2 Description: Each unit shall be a down-fired firetube type complete with burner and automatic controls. The boiler, with all piping and wiring, shall be a factory package. Each boiler shall be neatly finished, thoroughly tested and properly packaged for shipping. Boiler design and construction shall be in accordance with Section IV of the ASME Code for hot water heating boilers with a maximum working pressure of 125 PSIG.

.3 Duplex stainless steel has superior corrosion resistance, and minimal thermal stresses compared to other grades of stainless steel. The counterflow design puts the coldest flue gases in contact with the coldest return water, maximizing condensing potential.

.4 The heater exchanger shall bear the ASME "H" stamp for 160 psi working pressure and shall be National Board listed. There shall be no banding material, bolts, gaskets or "O" rings in the heat exchanger design.

.5 Heat Exchanger: Duplex stainless steel tubes, tube sheets, and combustion chamber. The heat exchanger shall be a single-pass, counter-flow arrangement.

.1 The firetubes shall be duplex stainless steel, fitted with aluminum internal heat transfer fins.

.6 Pressure Vessel: Carbon steel with welded heads and tube connections.

.7 The boiler shall have one supply connection with dual return water connections. The dual return water connections shall enable the boiler to operate in a condensing mode when as little as 10% of the flow is returned to the low temperature return with a maximum temperature of 120°F.

.8 Water volume is crucial to the boiler's ability to handle varying flow conditions and reduce cycling. Low water volume boilers are more susceptible to short cycling, and nuisance trips. They often have minimum and maximum flow requirements to protect the heat exchanger.

.9 The boiler pressure vessel shall have a minimum of 42 gallons of water volume/1000 MBH input.

.10 Many condensing boilers have minimum flow requirements. When designing a system, make sure all specified boilers can handle system design conditions.

.11 The boiler shall be low flow tolerant without minimum flow requirements or the use of a flow switch.

.12 Effective fireside heating surface has a direct correlation to the ability of the boiler to condense over a wide range of operating conditions. Since moisture in the flue gases condense on the surface of the tubes, greater amounts of fireside heating surface give the flue gases a larger area to condense on, leading to more efficient operation.

.13 The boiler shall have a minimum of 200 sqft/1000 MBH of effective fireside heating surface.

.14 If jobsite altitude exceeds 2000 ft ASL review equipment capacity and requirements with local Cleaver Brooks representative. Select natural gas or propane gas.

.15 Burner: Natural gas, forced draft burner mounted in and integral with the boiler hinged top door so when the door is opened the burner head, furnace, tubesheet, and tube entrances are exposed. The burner door shall utilize easy removable threaded handles, and the burner shall swing upward on gas assist piston arms, one on each side to provide open support of the burner assembly.

.1 The burner shall be a linkage-less, self-regulating, air-fuel ratio gas valve-venturi system. Burner regulation shall be accomplished without the use of fuel/air mixing valves.

.2 The burner shall ~~be~~ achieve sub 20 ppm NOx when firing on natural gas at all firing rates.

.3 Burner and fireside access shall be able to be performed by one service technician.

.16 Burner Head: shall be constructed of a stainless steel metal fiber for solid body radiation of the burner flame. Combustion shall take place on the surface of the burner mantle, which shall be constructed of a woven stainless steel metal fabric resulting a 360 degree low temperature radiant flame.

.1 Burner shall be capable of minimum 10:1 fully modulating turndown (Natural gas).

.2 Burner shall maintain no more than 7% O_2 levels throughout the firing rate without additional sensors, linkages, or controls.

.1 The pre-mix design shall utilize a variable speed fan connected to a venturi to simultaneously modulate the fuel and air for a minimum 10:1 turndown. The gas valve-venturi design shall also act as a method for compensating for changes in barometric pressure, temperature, humidity and air-density so the excess air levels are not adversely affected by changes in atmospheric conditions. External linkages and single speed fans shall not be acceptable.

.17 Blower: Boiler shall be equipped with a pulse width modulating centrifugal fan to precisely control fuel/air mixture for burner firing and to pre-purge and post-purge the combustion chamber.

.1 The blower motor shall have a variable speed ECM motor with integrated drive electronics. Constant speed motors and variable frequency AC drives are not acceptable.

.18 Gas Train: The gas train shall meet the requirements of CSA/UL and ASME CSD-1 and shall include:

.1 Low Gas Pressure Interlock, manual reset.

.2 High Gas Pressure Interlock, manual reset.

.3 Upstream and downstream manual test cocks.

.4 Ball Type manual shutoff valve upstream of the main gas valve.

.5 Unibody double safety gas valve assembly.

.6 Gas Pressure Regulator

.7 Union connection to permit burner servicing.

.19 UV scanner for flame supervision.

.20 Ignition: Spark ignition with 100 percent main-valve shutoff with electronic flame supervision.

.21 Combustion air proving switch shall be furnished to ensure sufficient combustion airflow is present for burner ignition firing.

.22 To ensure that the flue is not blocked, the burner shall include a High Air Pressure Switch sensing the outlet pressure connection relative to stack backdraft.

.23 Casing:

.1 Jacket: 18 gauge metal cabinet with snap-in or interlocking closures.

.2 Control Compartment Enclosures: NEMA 250, Type 1A.

.3 Finish: Powder-coated protective finish.

.4 Insulation: Minimum 2-inch thick, mineral-fiber insulation surrounding the heat exchanger.

.5 CFC-E boilers come standard with direct vent connection for ducted combustion air, or room air can be utilized. For room air and direct vent, the combustion air filter kit can be used.

.6 Combustion-Air Connections: Inlet and vent duct collars.

.1 Combustion air inlet filter

.2 TRIM

.1 Safety valve(s) shall be ASME Section IV approved side outlet type mounted on the boiler air vent outlet. Size shall be in accordance with code requirements and set to open at 75 psig.

.2 Temperature and pressure gauge shall be mounted on the water outlet.

.3 Solid State Low water cut-off probe control with manual reset and test switch.

.4 Manual Reset High Limit Temperature sensor; range not to exceed 210 deg F and shall be an integral device of the Boiler Burner Control and UL Recognized as a limit control.

.5 Outlet water supply sensing probe for operating water limit setpoint.

.6 Return water-sensing probe for operating limit setpoint.

.7 Drain valve

.8 Automatic air vent

.9 Auxiliary low water cutoffs are rarely required for hot water boilers. Review and include only if required for specific jobsite or Code requirements.

.10 Auxiliary low water cutoff

.11 Optional separate 100 dBA horn is available.

.12 Alarm lights and horn (general alarm light – red, fuel valve light – green, load demand light – white, low water light - amber)

.13 Stack temperature sensor – UL Recognized as a limit control.

.14 The condensate treatment tube is rated for capacities up to 1000 MBH. The tank and combo tank/trap are each rated for 8000 MBH total. The boiler must be on a housekeeping pad to use the combination tank/trap option. Multiple boiler condensate drains can be combined into one tank (or tank/trap) as long as they do not exceed the rated capacity.

.15 Condensate neutralization kit combination tank and trap

.16 If the system is piped primary only, consider providing the automatic isolation valves as a factory option. If by others, delete the below item.

.17 Automatic isolation valve, including valve, actuator, and transformer to power isolation valve through the boiler. The valve, actuator, and transformer shall ship loose for field installation and wiring.

.1 The isolation valve shall be Bray 2-way resilient seated butterfly valve, model ABL or Approved Equal in accordance with frontend clause B6, with ANSI 150# flanges, lugged style.

.2 The electric actuator shall a Bray Commercial actuator, or Approved Equal in accordance with frontend clause B6, 24VAC, fail in position, with auxiliary end switch.

.3 CONTROLS

.1 The Boiler shall include integrated boiler controls, which shall be a microcontroller board capable of sequence indication, fault reset, mode selection, and parameter set-point. It shall be mounted at the front of the boiler panel for easy access and viewing.

.1 The control board shall provide for both flame safeguard and boiler control and shall perform the following functions:

.2 Burner sequencing with safe start check, pre-purge, electronic direct spark ignition and post purge. Electronic flame sensing shall be used to prove combustion.

.3 Flame Supervision. The integrated controls shall provide pre-purge and post-purge and shall maintain a running history of operating hours, number of cycles, and the most recent fifteen lockouts. The control board shall be connected to a 7-inch colored touchscreen display interface that will display this information in clear English text with a user interface.

.4 Safety Shutdown with display of lockout or hold condition.

.5 PID modulating control of the variable speed fan for firing capacity relative to load requirements; i.e. to meet supply water temperature set point.

.6 Gas pressure supervision, high and low.

.7 Combustion Air Proving Supervision.

.8 High Air Pressure [back draft too high] Supervision.

.9 The supply temperature and set-point temperature shall be displayed at all times on the touch screen display.

.10 The control board shall communicate with the 7-inch colored touch screen display for set up, troubleshooting, and operational display, and shall include ModBus communication capability of this information.

.11 Include the programming for variable speed pump control with set temperature differential or isolation valve control and support the control of 2 heating demand loops.

.2 All parameter input control set-points shall be factory pre-configured. Parameter settings are to be established to suit jobsite conditions -- settings are to be configured at the time of initial jobsite operation.

.3 All controls to be panel mounted and so located on the boiler as to provide ease of servicing the boiler without disturbing the controls and also located to prevent possible damage by water according to UL and CSA requirements.

.4 When multiple boilers are to be installed together, a system integration control shall be provided to stage up to 8 boilers. The control shall include automatic selection of needed boilers based on energy demand, an adjustable outdoor reset schedule, domestic hot water priority, and a system digital display. The control shall stage and modulate the boilers utilizing firing rate threshold staging and parallel modulation to optimize condensing potential while minimizing energy wasting short cycling. This strategy takes full advantage of the inverse efficiency characteristic (lower fire rate, higher efficiency) of condensing boilers. The control shall monitor supply water temperature, return water temperature and shall communicate between boilers via RS-485 network wiring. The controls shall have a built-in feature to switch host boiler status among the client boilers if the assigned host boiler is not operational in a lead/lag setting.

.5 Boilers ship equipped with BACnet IP or Johnson Metasys N2 gateway interface, refer to Controls Contractor, to communicate with the building management system.

.1 Protocol translator mounted in a NEMA 1 panel with power supply and terminals.

.6 The boiler controls shall include provisions for outside air reset.

.7 The boiler controls shall include provisions for sending signal to start/stop primary boiler pump and vary pump speed based.

.9 Boiler shall have capability to have 24/7 remote monitor without connections to a BMS through an encrypted secure channel. The remote interface shall have the following features and capabilities

.1 Display real time boiler system operation, cycle counts, temperature readings, and runs hours, firing rate, steam pressure, inlet/outlet water temps, alarms, stack temperature, and more.

.2 View data on mobile app and customizable online dashboard.

.3 Multiple user authorization with different levels of access.

.4 Multiple site integration to allow user to see all boiler plants and control individual plants.

.5 Email and text alerts.

.6 Data trending.

.4 ELECTRICAL POWER

.1 Single-Point Field Power Connection: Factory-installed and -wired electrical devices necessary shall provide a single-point field power connection to boiler. Separate power and control connections will not be allowed.

.1 Electrical connection will be 460/3/60 for Single-Point Field Power Connection for CFC-E 3000-6000. Retain line item “1” if different

voltage is required for 3000-6000 MBH only. Delete line 1 if not applicable.

.2 Provide ship loose transformer to accommodate 575/3/60 voltage.

.3 House in NEMA 250, Type 1 enclosure.

.4 Wiring shall be numbered and color coded to match wiring diagram.

.5 Install factory wiring outside of an enclosure in a metal raceway or conduit.

.6 Select disconnect option below if disconnect is to be provided with boiler. If by others, delete item below.

.7 Field power interface shall be to fused disconnect switch.

.5 VENTING

.1 Exhaust Stack: Complete system, per UL 1738 for Category IV appliances, stainless steel, pipe, vent terminal, thimble, vent adapter, and sealant.

.1 Stack to be designed and manufactured by boiler manufacturer.

.2 Combustion-Air Intake: Complete system, stainless steel, pipe, vent terminal with screen, inlet air coupling, and sealant, by others.

.6 SOURCE QUALITY CONTROL

.1 Burner and Hydrostatic Test: Factory pressure test gas train, test fire burner and gas train assembly, and perform a functional controls test for all safety devices; perform hydrostatic test.

.2 Test and inspect factory-assembled boilers, before shipping, according to most current ASME Boiler and Pressure Vessel Code.

.7 PERFORMANCE

.1 Refer to Schedule on drawings.

.8 ACCEPTABLE PRODUCT

.1 Cleaver Brooks CFC-E-700-2500 or Approved Equal in accordance with frontend clause B6.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 General:

.1 Install packaged boilers in accordance with the Regulations of the Province of Manitoba, Mechanical Engineering and Inspections Branch.
.2 Tear-down boiler as required and/or provide cutting & patching to facilitate movement of boilers into the mechanical room. Re-assemble once boilers are in mechanical room and restore cutting & patching areas.
.3 Install all necessary service and appurtenance connections required for complete installation.
.4 Arrange and pay for supervised Office of the Fire Commissioner Inspection and Technical Services Manitoba (OFC ITSM) start-up of boilers.

.2 Make required piping connections to inlets and outlets recommended by boiler manufacturer.

.3 Maintain clearances as indicated or if not indicated, as recommended by manufacturer for operation, servicing and maintenance without disruption of operation of any other equipment/system.

.4 Mount unit level on concrete housekeeping pads and secure with drilled anchors bolts supplied by Contractor in accordance with manufacturer's recommendations.

.5 Natural gas fired installations - in accordance with CAN/CSA-B149.1.

.6 LP gas installations - in accordance with CAN/CSA-B149.1.

.7 Oil fired installations - in accordance with CSA-B139.

3.3 MOUNTING AND ACCESSORIES

.1 Safety valves and relief valves:

.1 Run separate discharge from each valve.
.2 Terminate discharge pipe as indicated.

3.4 FIELD QUALITY CONTROL

.1 Commissioning, by manufacturer's factory trained representative with assistance by Contractor:

.1 Manufacturer to:

.1 Certify installation.
.2 Start up and commission installation with support from Contractor.
.3 Carry out on-site performance verification tests.
.4 Demonstrate operation and maintenance.

.2 Contractor to co-ordinate supervised start-up with OFC-ITSM in coordination with manufacturer's start-up technician and The City's representative.

3.5 TRAINING

.1 Operation and maintenance training of The City to be provided by the equipment supplier and installation Contractor.

3.6 CLEANING

.1 Proceed in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Materials and application of electric and hydronic duct heaters.

1.2 REFERENCES

.1 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act (CEPA).
.2 Transportation of Dangerous Goods Act (TDGA).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 21 05 01 General Provisions - Mechanical.

.2 Submit product data and include:

.1 Coil support details.
.2 Coil capacities.
.3 Maximum/minimum discharge temperature.
.4 Physical size.
.5 Unit support.
.6 Performance limitations.
.7 Pressure drop at operating airflow.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with manufacturer's written instructions.

Part 2 PRODUCTS

2.1 DUCT MOUNTED HYDRONIC HEATING & COOLING COILS

.1 Performance: Refer to schedule on drawings.

.2 Coils shall be 5/8" O.D., constructed of copper tube, aluminum fin, and copper headers with schedule 40 steel pipe connectors.

.3 Fins constructed of aluminum shall be rippled for maximum heat transfer and shall be mechanically bonded to the tubes by mechanical expansion of the tubes. The coils shall have a galvanized steel casing. All coils shall be factory tested with air at 300 psig (2070 kPa) while immersed in an illuminated water tank.

.4 Headers with schedule 40 steel pipe connections utilize sweat connections.

.5 Glycol coils shall be circuited to provide adequate tube velocities to meet design requirements. Internal turbulators are not acceptable.

.6 5/8" O.D. tube diameter water coils shall be AHRI Certified.

.7 Contractor shall provide stainless steel slopped condensate pan for all cooling coils. Pipe condensate to nearest floor drain.

.8 Acceptable Manufacturer: Refer to schedule on drawings.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with SMACNA installation details with sloped condensate drain pan. Refer to detail on drawings.

3.2 PIPING INSTALLATION

.1 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated

.2 Install pipe to conserve headroom and space.

.3 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings

.4 Ream pipes, clean scale and dirt, inside and outside, before and after assembly

.5 Assemble piping using fittings manufactured to ANSI standards

3.3 TESTING

.1 Test system in accordance with Section 21 05 01 – General Provisions - Mechanical.

.2 Repair any leaking joints, fittings or valves.

3.4 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME Boiler and Pressure Vessel Code.

.2 CSA International

.1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit submittals in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for heat exchangers and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Shop drawings to indicate project layout, including layout and dimensions of heat exchangers and system.

.1 Indicate manufacturer's recommended clearances for tube withdrawal and manipulation of tube cleaning tools.

.4 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Manufacturer's Instructions: submit manufacturer's installation instructions.

1.3 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: submit operation and maintenance data for heat exchangers for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labeled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect heat exchangers from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

Part 2 PRODUCTS

2.1 PLATE & FRAME HEAT EXCHANGER, HEX-1

.1 Performance: Refer to schedule on drawings.

.2 Design:

.1 Units should be designed as single pass units unless thermal and hydraulic connections require multi-pass arrangement.
.2 All connections should be located on the fixed head, frame plate, allowing the moveable head, pressure plate, to slide back and plates added, removed or replaced from the plate pack without disturbing the connections or associated piping.
.3 Unit should allow for removal of interior plates without the removal of the plates.
.4 Unit shall be provided with an aluminum or stainless steel OSHA splash shield.
.5 Unit shall be designed, hydro-tested and U-1 stamped in accordance with ASME Section VIII Division 1.
.6 Manufacturer must be certified and registered with ISO 9001:2008. A certificate of registration shall be supplied upon request.

.3 Frame:

.1 The frame plate and pressure plate should be carbon steel SA 516 grade 70.
.2 The frame and pressure plate shall be of sufficient thickness to meet the ASME design pressure. Stiffeners and support brackets are not allowed.
.3 Carbon steel frame components shall be painted with gray epoxy paint.
.4 Units shall be unlined or alloy lined studded ports to mate with raised face or flat faced ANSI flanges. Rubber liners are not allowed.
.5 Unit shall be built with thermal plates supported by the carry bar, top bar. The guide bar, bottom bar, shall only help properly align the plates.
.6 The carry and guide bar plate contact surfaces shall be corrosion resistant.
.7 Unit shall have a minimum of two mounting feet at the frame plate and one at the support column, if a support column is used in the design.

.4 Tightening Bolts:

.1 Tightening bolts shall be zinc plated carbon steel SA193 B7.
.2 All nuts shall be carbon steel SA 194 grade 2H and galvanized via electroplating of zinc coating.
.3 Mounting feet shall be zinc plated carbon steel.
.4 The tightening bolt assemblies shall include captive working nuts at the pressure plate, rear head, such that the unit can be opened and closed with one wrench form the front of the unit.

.5 Plates:

.1 Plates shall be pressed in a one step stamping process.
.2 Plates shall use an integral rolled edge handing system to provide a rigid hanger device between the plate and carry bar and guide bar. Welded on hanging brackets are not acceptable.
.3 The plate pack shall use a positive plate to plate alignment system to ensure proper plate to gasket seals throughout the plate pack. The positive alignment system shall either be a gasket lug which fits within a plate recess on the proceeding plate to align successive plates or an extended rolled edge hanger which nests success plates through direct contact around the entire plate hanger. Plate designs, which only offer alignment through contact with the carry and guide bar, are unacceptable.
.4 Plates shall be permanently marked to indicate plate material and thickness.
.5 Plates shall have an enclosing groove for the entire gasket designed to contain the gasket while allowing for thermal expansion.

.6 V Gaskets

.1 All gaskets except the gasket on the first plate shall be identical.
.2 The gaskets shall be one-piece construction with a double gasket barrier at the port region. The area isolated by the double gasket shall be vented to the atmosphere, so that a gasket failure is detected by a leakage to the exterior prior to any cross contamination.
.3 Gasket attachment methods, which break during gasket removal or plate maintenance thus destroying the gasket, are not allowed.
.4 Care should be taken in the selection of gasket materials to insure compatibility with the fluids and operating temperatures.

.7 Thermal/Hydraulic Design, Certification and Testing

.1 The manufacturer shall provide written guarantee to the accuracy of the heat exchanger thermal design.
.2 The manufacturer shall be certified with the Air-Conditioning and Refrigeration Institute's Liquid to Liquid Heat Exchanger Certification program AHRI Standard 400, the manufacturer is responsible to replace or repair the exchanger to achieve the stated performance.
.3 If the manufacturer is not certified with the Air-Conditioning and Refrigeration Institutes Liquid to Liquid Heat Exchanger Certification

program AHRI Standard 400, a witness factory performance test must be completed per the testing specification of AHRI 400.

.8 Accessories:

.1 Provide insulation blanket

.1 Removable insulation blanket construction shall be a double sewn lock stitch with a minimum of 4 stitches per inch. All jacket edges will have a tri-fold Silicon or PTFE Teflon Fiberglass cloth binding. No raw cut out jacket edge will be exposed. Stitching will be done with Teflon coated fiberglass thread.

.2 Fasteners to be wire tie or Velcro flaps.

.3 1" thick insulation with an R-value of 4.75 @ 75F.

.9 Approved Manufacturer: Armstrong, Bell & Gossett or Approved Equal in accordance with frontend clause B6

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for heat exchanger installation in accordance with manufacturer's written instructions.

3.2 INSTALLATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 General: install level and firmly anchored to supports in accordance with manufacturer's recommendations.

.3 Tube in shell heat exchangers: arrange piping so that tube bundle can be removed after disconnecting two unions or flanges adjacent to head and without disturbing other equipment and systems.

.4 Plate exchangers: install in accordance with manufacturer's recommendations.

3.3 APPURTENANCES

.1 Install with safety relief valve piped to drain.

.2 Install thermometer wells with thermometers on inlet and outlet of primary and secondary side.

.3 Steam Systems: install pressure gauges on steam inlet.

3.4 FIELD QUALITY CONTROL

.1 Site Tests and Inspections:

.1 Perform tests as directed by Contract Administrator to ensure heat exchangers are functional.

.2 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product.

3.5 SYSTEM START-UP

.1 Check heater for cleanliness on primary and secondary sides.

.2 Check water treatment system is complete, operational and correct treatment is being applied.

.3 Check installation, settings, operation of relief valves and safety valves.

.4 Check installation, location, settings and operation of operating, limit and safety controls.

.5 Check supports, seismic restraint systems.

.6 Timing: only after TAB of hydronic systems have been successfully completed.

.7 Primary side:

.1 Measure flow rate, pressure drop, and 2 water temperatures at heater inlet and outlet.

.1 Steam Systems: Verify operation of steam traps. Measure temperature of condensate return at trap outlet.

.2 Verify installation and operation of air elimination devices.

.8 Secondary side:

.1 Measure flow rate, pressure drop and water temperature at heater inlet and outlet.

.2 Verify installation and operation of air elimination devices.

.9 Calculate heat transfer from primary and secondary sides.

.10 Simulate heating water temperature schedule and repeat above procedures.

.11 Verify settings, operation, safe discharge from safety valves and relief valves.

.12 Verify settings, operation of operating, limit and safety controls and alarms.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by heat exchanger installation.

3.7 CLEANING

.1 Proceed in accordance with 21 05 01 General Provisions – Mechanical.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section includes design, performance criteria, refrigerants, controls, and installation requirements for air-cooled chillers.

1.2 REFERENCES

.1 Air-Conditioning, Heating, & Refrigeration Institute (AHRI)

.1 AHRI 550/590, Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle

.2 American National Standards Institute/American Society for Heating, Refrigerating, and Air-Conditioning Engineers (ANSI/ASHRAE)

.1 ANSI/ASHRAE 15, Safety Standard for Refrigeration Systems

.3 American Society for Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings

.4 Department of Energy (DOE)

.1 DOE Federal Energy Management Program (FEMP)

.5 Comply with applicable Standards/Codes of, ETL, cETL, NEC, and OSHA as adopted by the AHJ.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit submittals in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for chillers and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate:

.1 Equipment including connections, piping and fittings, valves, strainers, control assemblies and ancillaries, identifying factory and field assembled.

.2 Wiring as assembled and schematics.

.3 Dimensions, construction details, recommended installation and support, mounting bolt hole sizes and locations and point loads.

.4 Space requirements for operation and maintenance.

.5 Type of refrigerant used.

.6 Dimensioned plan and elevation view drawings, required clearances, and location of all field connections

.7 Spring isolators including spring rate, mounting details and locations,

.8 Summary of all auxiliary utility requirements such as electricity, water, etc. Summary shall indicate quality and quantity of each required utility.

.9 Single line schematic drawing of the field power hookup requirements, indicating all items that are furnished.

.10 Schematic diagram of control system indicating points for field interface/connection.

.11 Diagram shall fully delineate field and factory wiring.

.12 Installation and operating manuals.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Operation and Maintenance Data: submit operation and maintenance data for chillers for incorporation into manual.

.3 Data to include:

.1 Description of equipment giving manufacturers name, model type and, capacity and serial numbers.

.2 Submit part load performance curves.

.3 Details on operation servicing and maintenance.

.4 Recommended spare parts list.

1.5 QUALITY ASSURANCE

.1 Qualifications: Equipment manufacturer must specialize in the manufacture of the products specified and have five years experience with the type of equipment and refrigerant offered.

.2 Regulatory Requirements: Comply with the codes and standards specified.

.3 Chiller manufacturer plant must be ISO Registered.

1.6 DELIVERY AND HANDLING

.1 Chiller shall be delivered to the job site completely assembled and charged with refrigerant and oil by the manufacturer.

.2 Comply with the manufacturer's instructions for rigging and handling equipment.

1.7 MANUFACTURER'S MINIMUM EQUIPMENT WARRANTY REQUIREMENT

.1 Standard Warranty (Canada): The refrigeration equipment manufacturer's guarantee shall be for a period of one year from date of equipment start-up but not more than 18 months from shipment. The guarantee shall provide for repair or replacement due to failure by material and workmanship that prove defective within the above period, excluding refrigerant.

.2 1st Year Labor Warranty: None included

.3 Extended Compressor Warranty: None.

.4 Extended Unit Warranty: Entire unit (no pumps), four (4) years parts only.

.5 Refrigerant Warranty: None.

.6 Delay Warranty Start: None.

1.8 MAINTENANCE

.1 Maintenance of the chillers shall be the responsibility of The City and performed in accordance with the manufacturer's instructions.

Part 2 PRODUCTS

2.1 PACKAGED AIR –COOLED WATER CHILLERS

.1 Description: Factory-assembled and performance-tested water chiller complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, evaporator, condenser coils, condenser fans and motors, electrical power, controls, and accessories.

.2 Cabinet:

.1 Base: Galvanized-steel base extending the perimeter of water chiller. Secure frame, compressors, and evaporator to base to provide a single-piece unit.

.2 Frame: Rigid galvanized-steel frame secured to base and designed to support cabinet, condenser, control panel, and other chiller components not directly supported from base.

.3 Casing: Galvanized steel.
.4 Finish: Coat base, frame, and casing with rustproof polyester paint.

.3 Compressors:

.1 Description: Positive-displacement direct drive with hermetically sealed casing.
.2 Each compressor provided with suction and discharge service valves, crankcase oil heater, and suction strainer.
.3 Operating Speed: Nominal 3600 rpm for 60-Hz applications
.4 Capacity Control: On-off compressor cycling.
.5 Oil Lubrication System: Automatic pump with strainer, sight glass, filling connection, filter with magnetic plug, and initial oil charge.
.6 Vibration Isolation: Mount individual compressors on vibration isolators.
.7 Compressors must be enclosed in acoustically insulated and weatherproof compartment.
.8 There should be at least 4 or more compressors with 2 refrigerant circuits.

.4 Refrigeration:

.1 Refrigerant: R-454B. Classified as Safety Group A1 according to ASHRAE 34.
.2 Refrigerant Compatibility: Parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
.3 Refrigerant Circuit: Each circuit shall include a thermal-expansion valve, a reverse cycle valve, a liquid separator, a liquid accumulator, a filter-dryer, a sight glass with moisture indicator, a liquid accumulator, a liquid-line solenoid valve, and an insulated suction line.
.4 Each unit shall have two refrigeration circuits.

.5 Evaporator:

.1 Brazed Plate:
.1 Direct-expansion, single-pass, brazed-plate design.
.2 Type 316 stainless-steel construction.
.3 Heat exchanger shall have two independent refrigerant circuits, one water circuit
.2 Heater: Factory-installed and -wired electric heater with integral controls designed to protect the evaporator.
.3 Evaporator shall be provided with a factory installed inlet strainer.

.6 Air-Cooled Condenser:

.1 Condenser shall be constructed of microchannel
.2 Condenser shall use V-block configuration.
.3 Fans: Direct-drive propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge.

.4 Fan Motors: Inverter driven totally enclosed nonventilating (TENV) or totally enclosed air over (TEAO) enclosure, with permanently lubricated bearings, and having built-in overcurrent- and thermal-overload protection.

.5 Fan Guards: Steel safety guards with corrosion-resistant coating.

.6 Unit shall be able to modulate the fan speed based on high pressure when in cooling mode, and based on low pressure when in heating mode.

.7 Free Cooling

.1 Units shall be provided with integrated free cooling coils and 3-way diverting valves.

.2 During periods where the ambient temperature is 4 F degrees lower than the return water temperature the chiller shall divert return water through the free cooling coils for partial free cooling and then sent to the evaporator where it is taken to the design temp. Mechanical cooling shall resume to meet set point.

.3 When the chiller can maintain full cooling through free cooling, the mechanical cooling circuit shall be disabled and the set point shall be controlled via condenser fan modulation.

.4 Air-water exchangers with free-cooling function made of Cu pipes and Al blades blocked through the mechanical expansion of the pipes

.8 Noise level:

.1 Sound Power level from the chiller, in accordance with EN ISO 9614-2, shall be less than 90.1 dB (A).

.2 Sound pressure level from the chiller, in accordance with EN ISO 9614-2, shall be less than 65.6 dB (A).

.9 Controls:

.1 Unit shall be equipped with a standalone microprocessor based control system. The control logic shall be designed to maximize operating efficiency and equipment life with protections for operation under unusual conditions. The system shall intelligently stage the unit to sustain leaving water temperature precision and stability while minimizing compressor cycling.

.2 The controller shall support the following safety and operating controls: high pressure switches for each refrigerant circuit; loss of flow in the evaporator water circuit; condenser fan staging by head pressure; digital setting of low evaporator water temperature cutout, high pressure cutout, suction pressure cutout, and freeze protection cutout; compressor soft loading; demand limit control based on 4-20 mA DC signal input; automatic circuit lead/lag based on fewest operating hours (with manual override); chilled water reset based on an externally applied 4-20 mA signal.

.3 The keypad/display shall provide access to all vital equipment data. Data shall include full description of current unit status, set point parameters, and alarms.

.4 Control system shall: continuously perform self-diagnostic checks; monitor all system temperatures, pressures and safeties; and shall automatically

shut down a compressor, refrigerant circuit or entire unit should a fault occur. Diagnostic function shall provide operator with a pre-alarm status indication allowing time to take corrective action prior to a safety shutdown.

.5 Controller shall provide output contact closure for control of chilled water pump

.6 The chiller shall be capable of communications with any Building Automation System supporting BACnet, Modbus and LONworks communications protocol. The information communicated between the BAS and the factory mounted unit controllers shall include the reading and writing of data to allow unit monitoring, control and alarm notification as specified in the unit sequence of operation and the unit points list.

.10 PERFORMANCE:

.1 Refer to Schedule on Drawings.

.11 ACCEPTABLE PRODUCT:

.1 Aermec NYG1000XF°°J800° or Approved Equal in accordance with frontend clause B6.

2.2 SOURCE QUALITY CONTROL

.1 Chiller shall be manufactured in an ISO 9001 certified facility.

.2 Each unit shall be factory performance tested on a third party certified test stand to ensure proper operation, full load efficiency and full load capacity. Test reports shall be made available to The City and Contract Administrator upon request.

.1 Functional Test

.1 Pre-charge unit with nitrogen and test for leakage

.2 Establish a vacuum to remove all gas and to eliminate moisture inside the refrigerant circuit

.3 Charge the unit with refrigerant

.4 Connect the evaporator and condensers inlet and outlet water connections to the testing room plant

.5 Set the water flow to the design flow rate

.6 Connect power to the unit and carry out test of voltage and frequency on the electrical panel

.7 Program the microprocessor control with basic working parameters

.8 Set up the valves and trim the refrigerant charge

.9 Start up each compressor and test electrical data

.10 Set up all the pressure switches

.11 Calibrate the various temperature and pressure probes on the circuit

.2 Performance Test

.1 Test the following alarms on the microprocessor through run test

.1 High pressure alarm
.2 Low pressure alarm
.3 Compressors alarm
.4 Evaporator freeze alarm

.2 Test probe failures

.3 Run the chiller in the production climatic test chamber at full load conditions

.4 Record the performance data on the test report sheet and provide a copy to Contract Administrator and The City.

.3 Sound Compliance: Chiller sound power levels shall be rated according to ISO 9614-2 and sound pressure levels rated to ISO 3744 standards. If alterations are made to a standard chiller to comply with the sound requirements, the manufacturer must provide a sound performance test in a certified facility. It shall provide overall ”A” weighted sound pressure levels based on measurement taken 30 feet from the side of the heat pump.

.4 Products shall be designed, tested, rated and certified in accordance with, and installed in compliance with applicable sections of the following standards and codes:

.1 AHRI 550/590 and 551/591-water chilling packages using the vapor compression cycle

.2 AHRI 370-sound rating of large outdoor refrigerating and air-conditioning equipment

.3 ANSI/ASHRAE 34-Number designation and safety classification of refrigerants

.4 ASHRAE 90.2-Energy Standard of Building except Low-rise Residential Buildings

.5 ANSI/NFPA 70-National Electrical Code(N.E.C)

.6 Confirm to Intertek Testing Services for construction of chiller and provide ETL listed Mark.

.7 The unit should have IP24 protection level for outdoor installation.

.5 There should be arrangements for standard factory performance witness test on In-house AHRI certified test chambers. Custom factory test should be arranged to see the performance of the unit at any given operating conditions within limits of operating envelope for the specified unit’s size.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for water chiller installation in accordance with manufacturer's written instructions.

.2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Install in strict accordance with manufacturer's requirements, shop drawings, and Contract documents.

.2 Provide the necessary refrigerant charge for system operation.

.3 Adjust and level chiller in alignment on supports.

.4 Ensure adequate clearances for servicing and maintenance.

.5 Coordinate electrical installation with Electrical Subcontractor.

.6 Coordinate controls with control Contractor.

.7 Install a field-supplied or optional manufacturer-supplied strainer in the chilled water return line at the evaporator inlet; 40-mesh on units with brazed-plate evaporators.

3.3 START-UP

.1 Provide testing and starting of machine by manufacturer's trained representative, and instruct The City in its proper operation and maintenance.

.2 Return to site in peak summer conditions to confirm machine is operating to manufactures specifications. Test and measure operating conditions as necessary.

.3 Submit written start-up report complete with all recorded operating points and "as-built" parameter settings for chiller to engineer; include copy in O&M Manuals.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by water chiller installation.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 21 05 01 General Provisions – Mechanical. Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 21 05 01 General Provisions – Mechanical.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Materials, components and installation for heat reclaim devices.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 84, Method of Testing Air-to-Air Heat Exchangers (ANSI approved).

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 21 05 01 General Provisions – Mechanical. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 21 05 01 General Provisions – Mechanical.

.3 Quality assurance submittals:

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.4 Closeout Submittals:

.1 Provide operation and maintenance data for incorporation into manual specified in Section 21 05 01 General Provisions – Mechanical.

.5 Certificates:

.1 Catalogued or published ratings: obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.

.2 Provide confirmation of testing.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with manufacturer's written instructions.

1.5 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 21 05 01 General Provisions – Mechanical.

Part 2 PRODUCTS

2.1 GENERAL

.1 Comply with ASHRAE 84.

2.2 ENERGY RECOVERY VENTILATOR, ERV-1

.1 Performance: Refer to schedule on drawings.

.2 Post and Panel Construction:

.1 Cabinet Construction:

.1 The cabinet shall be fabricated from panels mechanically fastened to extruded aluminum posts.

.2 All doors shall be sealed with a permanent EPDM rubber gasket.

.3 The cabinet shall be built up on a steel or aluminum channel base, engineered to prevent deflection during rigging. Lifting lugs shall be bolted.

.2 Panels:

.1 Panels shall be 2 inch nominal thick construction.

.2 The outer panel and inner liner shall be constructed of 22 gauge galvanized steel or 12 gauge aluminum. Panels shall be removable without affecting the structural integrity of the entire unit. Outer Panels shall be painted as required.

.3 Roof panel construction shall match the wall panel construction. The roof skin shall include a 1-1/2 inch standing seam with a rain-guard drip-edge around the full perimeter.

.3 Access Doors:

.1 Access doors shall be 2 inch nominal thick construction, and shall be flush, hinged and supplied with handles.

.4 Finish:

.1 All exterior galvanized steel shall be coated with a weather resistant paint, as required, capable of withstanding surface degradation and substrate corrosion after at least 1500 hours of salt spray exposure (per ASTM B117).

.3 Supply/Return Fans:

.1 Direct drive airfoil plenum fans:

.1 The energy recovery unit shall be provided with direct-drive airfoil plenum supply and return fans. The fan assemblies shall be dynamically balanced and selected at speed below critical RPM.

.2 The fan and motor shall be mounted internally on a steel base-frame complete with spring vibration type isolators. The unit casing shall include a hinged access door to permit access to the motor, drive, and bearings.

.3 The motor shafts shall be steel construction, and shall be solid, ground and polished, keyed, and protectively coated with lubricating oil. Hollow shafts shall not be acceptable.

.4 Electrical:

.1 The air handler shall bear an ETL, UL, or CSA listing label. The electrical components shall be CSA, UL or CE listed, as applicable.

.2 The unit shall be supplied with a single point power supply connection.

.3 Terminal lugs shall be provided in accordance with the branch circuit conductor quantities, sizes, and materials indicated.

.4 All wires shall be tagged and cross-referenced to the wiring diagram for ease of troubleshooting.

.5 Fan motors shall be premium efficiency totally-enclosed fan-cooled (TEFC), driven with a variable-frequency drive (VFD). Electrical characteristics shall be as shown in the equipment schedule.

.5 Filters:

.1 The unit shall be supplied with filters supported in racks, which shall be accessible through hinged and latching access-doors on at least one side of the unit.

.2 The filter media shall be UL 900 listed, Class I or Class II.

.3 Filters shall be mounted in a flat or angled arrangement with 2 inch, 50 millimeter pleated panel filters, MERV 13.

.6 Energy Recovery Cores:

.1 The unit shall have sensible effectiveness of 90 percent (plus or minus 5 percent) in winter and up to 80 percent in summer. The unit shall also provide up to 70 percent latent recovery.

.2 Unit shall accomplish energy recovery without a defrost cycle down to -40 degrees Fahrenheit (-40 degrees Celsius). Devices employing defrost cycles that bypass the heat recovery device or reduce the effectiveness shall not be acceptable.

.3 The energy recovery cores shall consist of 0.032 inch thick type 1100 aluminum alloy plates.

.7 Dampers:

.1 The unit shall be supplied with a switchover damper system comprised of four multi-section, low-leakage, AMCA certified dampers.

.2 The dampers shall meet the following requirements:

.1 AMCA Leakage Class 1A at 1 inch water gauge static pressure differential.

.2 AMCA Leakage Class 1 at 4 inches water gauge static pressure differential.

.3 The dampers shall be operated by CSA-listed electric motors. The motors shall drive the dampers full-open to full-closed and full-closed to full-open in less than 0.75 seconds.

.4 The damper blades shall be aluminum for long life expectancy, and shall be insulated and thermally-broken dampers, as required to meet the job requirements.

.5 The switchover damper system shall be capable of closing off outside-air to the building without needing additional shut-off dampers.

.6 The unit dampers shall be capable of positioning to allow 100 percent recirculation of air without using the heat recovery device for off- peak or unoccupied heating modes. Units incapable of these operations shall not be acceptable.

.7 The unit dampers shall be capable of positioning to allow 100 percent outside air and exhaust without using heat recovery device for economizer mode.

.8 Unit capable of cold weather warm up mode without additional dampers.

.8 Controls:

.1 The unit shall have a microprocessor control system that provides digital control and visibility of the unit's operation and its systems.

.2 The controller shall contain an internally networked control structure allowing detailed querying of all installed components, locally or over the internet.

.3 The controller shall have the following features:

.1 Alarm log

.2 Run capacity display for cooling and heating

.3 Clock and calendar with battery back-up, leap year, and daylight saving time

.4 Service overrides and manual operation modes for all connected components

.5 Hour meters for total run time

.6 7 day programmable occupancy and on/off time schedules

.4 The controller shall be capable of being remotely operated via web browser or remote digital display.

.1 Remote operation of the controller shall provide the same functionality as operating the physical controller.

.2 Remote operation via a web browser will be facilitated through an Ethernet connection.

.3 Alarm and operational data logs are viewable and downloadable via web browser operation.

.5 The controller shall be capable of adjustable ambient lockout.

.6 The controller shall be capable of being integrated into building management systems via BACnet (IP, MS/TP).

.7 The controller shall have a backlit LCD screen and shall be menu driven. The screen commands and outputs shall be in plain English. Alphanumeric codes shall not be acceptable.

.8 The controller shall have battery back-up protecting all user settings in the event of a power outage.

.9 The controller shall function in ambient conditions from -4 to 140 °F (-20 to 60 °C) and 90% relative humidity (RH) non-condensing.

.9 Acceptable Product: Refer to schedule on drawings.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with manufacturers recommendations.

.2 Support independently of adjacent ductwork with flexible connections.

3.3 ENVIRONMENTAL

.1 Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

3.4 CLEANING

.1 Proceed in accordance with Section 21 05 01 General Provisions - Mechanical.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American National Standards Institute/Air-Conditioning and Refrigeration Institute (ANSI/ARI)

.1 ANSI/ARI 430, Central-Station Air-Handling Units.

.2 American Society of Heating, Refrigeration and Air Condition Engineers (ASHRAE)

.1 ANSI/ASHRAE 90.1, (I-P) Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 ANSI/ASHRAE 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.181, Ready-Mixed Organic Zinc-Rich Coating.

.4 Green Seal Environment Standards (GSES)

.1 Standard GS-11, Environmental Standard for Paints.

.5 Master Painters Institute (MPI)

.1 MPI-INT 5.3, Galvanized Metal

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for insulation, filters, adhesives, and paints, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate following: fan, fan curves showing point of operation, motor drive, bearings, filters, dampers; include performance data.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 21 05 01 General Provisions – Mechanical.

.2 Include following: fan, bearings, motor, damper, air volume, EDB, EWB, OAT, total heating, total cooling, sensible cooling.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Provide maintenance materials in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Spare filters: in addition to filters installed immediately prior to acceptance by Contract Administrator, supply one complete set of filters for each filter unit or filter bank.

.3 Provide list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 21 05 01 General Provisions - Mechanical.

.2 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.

Part 2 PRODUCTS

2.1 GENERAL

.1 Air handling unit shall be built to the level of quality as herein specified and to the description of the Air Handling Unit Schedule.

.2 Substitution of any product other than that specified must assure no deviation below the stated capacities, airflow rate, heat transfer rate, filtration efficiency and air mixing quality. Power requirements must not be exceeded. Applications for “equal” or “alternate” must address these factors.

.3 Pre-wired air handling units shall bear an approved label with all the necessary identification marks, electrical data, and any necessary cautions as required by the Canadian Electrical Code.

.4 All equipment shall be factory tested prior to shipment.

2.2 AIR HANDLING UNIT, AHU-1

.1 CONSTRUCTION

.1 The AHU are structure formed by corners cast aluminum, aluminum profiles and panels of minimum 20-gauge galvanized steel for interior and 20 gauge

for exterior with RAL 7035 paint, except for wet sections such as OA condensing coils, where all sections must be 304 stainless steel or better.

.2 Floor must be Galvanized gauge 20.

.3 Housing/Casing must be airtight, better than CL1 According to AHRI 1350-2014, LEAK TEST MUST BE PERFORMED IN THE AHU BEFORE LEAVING THE FACTORY, if units is composed of more than 2 pieces, the test must be repeated in the field, blanking all openings to allow for pressurization, all blanking plates must be provided as part of the AHU.

.4 Caulk must be polyurethane based and must not be used on the Reactivation section unless the product allows for the temperatures that will be exposed continuously.

.5 Doors must be no through metal construction with complete gasket (1 piece) that runs around the frame, a window must be provided with each door except for access doors for burners. Gasket on the door frame shall be EPDM mechanically fixed to the frame, adhesive style gasket is NOT acceptable for access doors. All doors working on negative pressure shall open to the outside of the AHU, all door working on positive pressure shall open to the inside of the AHU.

.6 Hatches and service doors shall be fixed, service doors shall allow for full exit of elements like: Coils, rotors, fans, fan motors, etc.

.7 Structural base should be of at least 6" Galvanized gauge 10 or Aluminum elements, fully welded and calculated for minimal distortion during rigging, Units larger than 10 ft, must be 8" or higher. Lifting lugs must be provided as part of the scope of the AHU.

.2 DESICCANT WHEEL

.1 Desiccant rotor media shall guarantee performance as per Specs, media must be inert material made of non-volatile binders and non-migrating drying material, in no situation, the adsorbent material should leave the media into the air stream, it shall be non-toxic.

.2 Gaskets/Air seals shall guarantee that NO two different flows are mixed (reactivation and process) and that the materials of the seals do not wear the rotor as Not to sit directly into the media on the periphery section.

.3 The wheel shall be tested to ASTM E84-90 for Surface Burning of Building Materials and shall achieve a Flame Spread index equal to 0 and a Smoke development index of 10.

.4 Drive mechanism must be chain or time belt, no flat or V belt is allowed.

.5 A sensor shall be provided to confirm Rotor Rotation and alarm the system when the rotor fails to turn.

.3 FANS

.1 Fans shall be backward curved centrifugal type for industrial duty and suitable for continuous operation.

.2 Fans shall be direct drive, TEFC high efficiency type.

.3 Fans shall include fan motor and variable frequency drive packaged with unit.

.4 All motors shall include shaft grounding ring to protect the motor bearings from electrical discharge machining due to stray shaft currents.

.4 COILS

.1 All Coils shall be provided with stainless steel 304 gauge 14 casing, if ocean front conditions are expected, Electrofin coating or Heresite coating must be provided on the coils.
.2 All coils must be fabricated according to AHRI 410
.3 Aluminum Fins at a maximum of 12 fins per inch.
.4 All headers must have a vent port at the highest point.
.5 All headers must have drains point to allow for a full coil drainage, such port must have an accessible valve to allow for draining without disassemble of parts.
.6 All Chilled water Condensing coils must be provided with a sloped insulated draining pan in SS According to ASHRAE 62 Specifications. If coils are in a vertical tandem, an intermediate pan must be provided and piped to avoid any water stillness.
.7 For Chilled water Coils, velocity across the coil must not exceed 500 FPM, incase this is not achievable, and Stainless-Steel mist eliminator must be provided and never to exceed 650 FPM at any circumstance.
.8 For Chilled water Coils containing EG or PG, the derated performance must be clearly presented on the cut sheets as well as % of glycol stated.
.9 For Hot water Coils or Steam Coils, velocity across the coil must not exceed 800 FPM.
.10 All drain pans regardless of condensing or non-condensing operation conditions, must be provided with a water level sensor.

.5 FILTERS

.1 Similar to Camfil Farr 30/30 or AAF.
.2 Media shall be non-woven, fine fibered material laminated to rigid backing to hold pleat formation, having minimum efficiency MERV 8 based on ASHRAE Test Standard 52.2 (average dust spot efficiency of 30 to 35% based on ASHRAE Test Standard 52.1
.3 Filter housing shall consist of air handling or cabinet fan unit manufacturer's low velocity filter section, or holding frame, as scheduled. When holding frame is indicated, it may be furnished by filter manufacturer or it may be Contractor fabricated
.4 Filters shall be 2” or 4” thick of size and capacity as scheduled. Clean filter pressure drop shall not exceed 0.31” WG based on 500 fpm face velocity.
.5 Filter Pressure Drop Switch
.1 Belimo Series APS shall be provided across each individual filter bank in built-up rack assemblies, suitable for flush mounting in a panel, including air filter switch accessory package for use with 1/4” polyurethane tubing.

.6 DAMPERS

.1 Outside, return and reactivation dampers shall be motorized with proportional actuator, opposed blade with jamb seals and lip seals, in case a Dampers works as a control damper and isolating damper, motor must be spring return fail close configuration.

.2 All levers or moving mechanism that can be a cause of pinching or entrapment, must be covered for safety purposes and clearly marked.

.7 REACTIVATION SYSTEM

.1 Reactivation fan shall have a constant volume fan with a piezo electric measuring device to adjust the speed on the fan to allow for the correct pressure requirements on the purge system.

.8 CONTROL PANEL

.1 Advanced Control panel with Touch display controller for real time monitoring and control of all components of the dehumidifier, prepared for all requested internal and external signals for setting a proportional humidity control, acting on a installed solid state relay resistances or reactivation fluid control valve. Electrical panel in galvanized steel IP54 epoxy painted assembled to the unit. Including isolator switch and appropriate internal magneto-thermal protection of receivers and internal wiring. All as per UL-CSA security / electrical / EMC regulation, complete monitoring and easy service. Includes manual / auto selector, on / off remote switch, remote signaling card through 3 free dry contacts: On / Power / Fault (includes rotor stop alarm). Intelligent turning-off for electrical reactivation. 24 V voltage for control and supply. Bus communication option available.

.2 NEMA 4 or 3R shall be provided for Outdoor applications.

.9 PERFORMANCE

.1 Refer to Schedule on drawings.

Part 3 EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Provide appropriate protection apparatus.

.2 Install units in accordance with manufacturer's instructions and as indicated.

.3 Ensure adequate clearance for servicing and maintenance.

3.3 FANS

.1 Install fan sheaves required for final air balance. Additional fan sheaves shall be provided by the supplier and installed by the Contractor if required to achieve proper air balance.

.2 Install flexible connections at fan inlet and fan outlets.

.3 Install vibration isolators.

3.4 DRIP PANS

.1 Install deep seal P-traps on drip lines.

.2 Depth of water seal to be 1.5 times static pressure at trap.

3.5 FIELD QUALITY CONTROL

.1 Provide factory trained representative to provide training and perform an Office of the Fire Commissioner Inspections and Technical Services Manitoba (OFC-ITSM) supervised start-up,

.2 Manufacturer's Field Services:

- .1 Have manufacturer of products supplied under this Section review work involved in handling, installation/application, protection and cleaning of its products, and submit written reports, in acceptable format, to verify compliance of work with Contract.
- .2 Provide manufacturer's field services, consisting of product use recommendations and periodic site visits for inspection of product installation, in accordance with manufacturer's instructions.
- .3 Schedule site visits to review work at stages listed:
  - .1 After delivery and storage of products, and when preparatory work on which work of this Section depends is complete, but before installation begins.
  - .2 Upon completion of work, after cleaning is carried out.

.3 Obtain reports within 3 days of review and submit immediately to Contract Administrator.

.4 Verify accessibility, serviceability of components including motorized dampers, filters coils, fans, motors, operators, sensors, electrical disconnects.

.5 Verify accessibility, cleanability, drainage of condensate drains.

.6 Performance Verification:

- .1 Air Handling Units:

.1 Check for smooth, vibration less correct rotation of supply fan impeller.

.2 Measure supply fan capacity.

.3 Adjust impeller speed as necessary and repeat measurement of fan capacity.

.4 Measure pressure drop each component of air handling unit.

.5 Set outside air and return air dampers for the % of outside air required by design and repeat measurements of fan capacity.

.6 Reduce differences between fan capacity at minimum and maximum outside air less than 5%.

.7 OAD: verify for proper stroking, interlock with RAD.

.8 Measure DBT, WBT of SA, RA, EA.

.9 Measure flow rates (minimum and maximum) of SA, RA, EA, relief air.

.10 Simulate maximum heating load and:

.1 Verify temperature rise across heat exchanger.

.2 Perform flue gas analysis. Adjust for peak efficiency.

.3 Verify combustion air flow to heat exchanger.

.4 Simulate minimum heating load and repeat measurements.

.11 Verify operating control strategies, including:

.1 Heat exchanger operating and high limit.

.2 Freeze protection.

.3 Economizer cycle operation, temperature of change-over.

.4 Alarms.

.5 Voltage drop across thermostat wiring.

.12 Measure leakage past zone mixing dampers by taking temperature measurements. Reduce leakage to less than 5%.

.13 Check capacity of heating unit.

.14 Refer to other sections of these specifications for PV procedures for other components.

.7 Commissioning Reports:

.1 In accordance with Section 23 05 93 – TAB of Mechanical System.

3.6 DEMONSTRATION

.1 Training: in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Contractor to co-ordinate, arrange and pay for Office of Fire Commission inspections.

3.7 CLEANING

.1 Clean in accordance with Section 21 05 01 General Provisions – Mechanical.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Outdoor condensing units.

1.2 REFERENCES

.1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA)

.1 ANSI/AMCA 210/ASHRAE 51, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.2 American National Standards Institute/Air-Conditioning, Heating and Refrigeration Institute (ANSI/AHRI)

.1 AHRI 450, Performance Rating of Water-Cooled Refrigerant Condensers, Remote Type.
.2 ANSI/AHRI 495, Performance Rating of Refrigerant Liquid Receivers.
.3 ANSI/AHRI 520, Performance Rating of Positive Displacement Condensing Units.
.4 AHRI 710, Performance Rating of Liquid Line Driers.

.3 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 17, Method of Testing for Capacity Rating of Thermostatic Refrigerant Expansion Valves.
.2 ASHRAE 15, Safety Standard for Refrigeration Systems.

.4 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)

.1 ASME B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.
.2 ASME B16.29, Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
.3 ASME B31.5, Refrigeration Piping and Heat Transfer Components.
.4 ASME B16.34, Valves Flanged Threaded and Welding End.

.5 American National Standards Institute/American Welding Society (ANSI/AWS)

.1 ANSI/AWS A5.8/A5.8M, Specification for Filler Metals for Brazing and Braze Welding.

.6 American Society of Mechanical Engineers (ASME)

.1 ASME Boiler and Pressure Vessel Code,

.7 ASTM International

.1 ASTM B 280, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

.8 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-19.13, Sealing Compound, One Component, Elastomeric, Chemical Curing.

.9 CSA International

.1 CSA B52 SMART, Mechanical Refrigeration Code.
.2 CAN/CSA-O80 Series, Wood Preservation.

.10 Environment Canada, Environmental Protection Service (EPS)

.1 EPS 1/RA/2, Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit submittals in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for cooling equipment and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit diagrams of field installation, internal wiring and piping for field assembly, with refrigerant flows, pipe sizes, pressure drops in equipment and suction lines.

1.4 QUALITY ASSURANCE

.1 Process refrigeration manufacturer: regularly engaged in production of specified equipment, and issues catalogue information with correction factors where published ratings shall be based on parameters different from those specified.

.2 Installation: performed by certified refrigeration mechanics/technician.

.3 Installation must comply with requirements listed in EPS 1/RA/2.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.2 Ship equipment factory dehydrated and sealed with dry nitrogen with tracer or full charge of refrigerant where permitted by authorities having jurisdiction and charge of lubricating oil.

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect cooling equipment from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

1.6 WARRANTY

.1 Contractor hereby warrants that refrigerant piping system loss of refrigerant and satisfactory operation of welded hermetic compressor will for minimum 1 year after start-up.

Part 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

.1 Supply, install and commission equipment shown on project drawings and specified below.

2.2 CONDENSING UNIT, CU-1

.1 GENERAL

.1 Variable Refrigerant Flow (VRF) outdoor unit can be configured to operate as a Heat Pump system or a Heat Recovery System.
.2 Dual frame outdoor unit combinations shall be connected to AHU coil with a single refrigerant piping system using factory designed and supplied Y-branches, Headers, and/or Heat Recovery Units and have integrated controls.
.3 The system shall be capable of being designed for minimum piping and maximum design flexibility.
.4 Each Heat Recovery Unit piping port shall be independently capable of operating in either heating or cooling mode regardless of the mode of other piping ports on the same heat recovery unit or in the system.
.5 The Heat Recovery Unit shall be capable of changing mode of individual indoor units or zones (cooling to heating or heating to cooling) within a maximum time frame of three (3) minutes to ensure indoor temperature can be properly maintained.
.6 Components shall be manufactured in a facility registered to ISO 9001 and ISO 14001, which shall be a set of standards applying to environmental protection set by the International Organization for Standardization (ISO). The units shall be Electrical Testing Laboratories (ETL) listed and bear the ETL label. All internal wiring shall be in accordance with the National Electrical Code (NEC).

.2 TEMPERATURE RANGES

.1 In Heat Pump configuration, the system can operate in heating only mode (i.e. all indoor units in heating mode) from -22°F to 61°F outdoor ambient wet bulb.
.2 Heat Pump systems can operate in cooling mode from 5°F to 122°F outdoor ambient dry bulb.
.3 Low ambient cooling kit shall extends the cooling only operating range down to -9.9°F.

.3 CASING/FRAME

.1 Outdoor units shall be constructed with galvanized steel, bonderized and finished with baked enamel paint.
.2 Each frame shall have a removable inspection panel to allow access to service tool connections, DIP switches, auto addressing, and error codes.
.3 The entire front panel of the outdoor unit shall be removable for maintenance.
.4 Outdoor unit frames shall be completely factory assembled, piped and wired.
.5 Dual frame outdoor units shall be field piped with factory designed and supplied outdoor unit Y-branch kits to manifold them together into a single refrigerant circuit.

.4 REFRIGERANT SYSTEM

.1 The refrigeration system consists of a single refrigeration circuit and uses R410A refrigerant.
.2 The outdoor unit shall be provided with factory installed components, including a refrigerant strainer, check valves, oil separator, oil level sensor, accumulator, four-way reversing valves, electronically controlled expansion valve (EEV), high and low side charging ports, high pressure safety switch, service valves, and interconnecting piping.
.3 Also included shall be an integral subcooler assembly consisting of a double spiral tube-type subcooling heat exchanger and EEV providing modulation of up to 23ºF subcooling.

.5 COMPRESSORS

.1 All 3-phase outdoor unit frames ≤130MBh nominal capacity shall be equipped with one digitally controlled inverter-driven hermetic scroll compressor to modulate capacity (variable from 12 to 150Hz).
.2 All 3-phase outdoor unit frames ≥130MBh nominal capacity shall be equipped with two digitally controlled inverter-driven hermetic scroll compressors to modulate capacity (variable from 12 to 150Hz).
.3 An internal thermal overload, and a factory-mounted 60 watt crankcase heater shall be included on all compressors.

.6 OUTDOOR UNIT COIL

.1 The outdoor unit coils shall be of a nonferrous construction with louvered aluminum fins on copper tubing, and shall be protected by a metal guard.

.2 Coil fins have a factory applied corrosion resistant Black Fin™ and hydrophilic coating.

.7 FANS AND MOTORS

.1 All outdoor unit frames (575V) include two direct drive, variable speed, biomimetic enhanced, propeller type fans.
.2 All fan motors have inherent protection, permanently lubricated bearings, and shall be variable speed with a maximum speed up to 1,150 rpm.
.3 Fan guards shall be provided to limit contact with moving parts.
.4 All Heat Pump / Heat Recovery outdoor units have vertical discharge airflow.
.5 Optional air guides can be field installed to change discharge airflow from vertical to horizontal.
.6 Outdoor units have an additional static pressure capability up to 0.32" WG with a DIP switch setting.

.8 ELECTRICAL

.1 Outdoor units shall be available in 575V/60 Hz/3-phase.
.2 The unit controls include current protection logic.

.9 CONTROLS

.1 Outdoor units shall be factory wired with necessary electrical control components, integral microprocessors, printed circuit boards, thermistors, sensors, terminal blocks, and lugs for power wiring.
.2 The control circuit between the indoor units, heat recovery units, and outdoor unit shall be a variable low voltage DC communication completed using a two conductor, stranded, and shielded cable for the RS-485 daisy chain communication wiring.
.3 Microprocessor-based algorithms provide component protection, soft-start capability, refrigeration system pressure, temperature, defrost, and ambient control.

.10 SYSTEM FEATURES

.1 Advanced Smart Load Control

.1 Automatically adjusts system target pressures based on outdoor temperature and humidity for increased cooling and heating performance.

.2 Intelligent Heating

.1 By monitoring the outdoor ambient humidity, the target high refrigerant pressure and compressor frequency can be reduced to extend heating operation, delay defrost operation initialization, and reduce power consumption.

.3 Comfort Cooling

.1 By monitoring the indoor temperature and setpoint differential, the target indoor unit refrigerant superheat and flow rate can be adjusted for improved comfort and cooling efficiency.

.4 HiPOR™ (High Pressure Oil Return)

.1 Refrigerant oil shall be captured from the compressor discharge by the centrifugal oil separator and then returned to the compressor through a separate oil injection pipe, preventing efficiency loss inherent in returning oil to the suction side of the compressor.

.5 Smart Oil Control

.1 Actively monitors the oil level inside each compressor and only initiates an oil return cycle to flush oil in the piping system back to the compressor oil sump when the oil level shall be too low, preventing the need for timed oil return cycles while maintaining proper oil level.

.6 Active Refrigerant Control

.1 Depending on the operating mode and conditions, the system refrigerant level shall be automatically adjusted for increased part load and heating operation efficiency.

.7 Variable Path Heat Exchanger

.1 Depending on the operating mode and conditions, both the refrigerant flow path and velocity shall be adjusted automatically for improved efficiency.

.8 Vapor Injection

.1 In heating mode, warm refrigerant vapor discharged by the subcooling heat exchanger shall be injected into the compressor scroll chamber, improving heating performance at low outdoor ambient conditions.

.9 Advanced PCB Cooling

.1 Improved cooling performance of the inverter drive control board by using liquid refrigerant instead of heat pipe or heat sink cooling methods using outdoor fan airflow.

.11 ACCESSORIES

.1 AHU Communications Kit

.1 Allows communication between third-party air handling unit controllers and air source and water source units

.2 3 - Thermistor (Return air, pipe in, and pipe out. Each 16.4 ft in length.)

.3 EEV Control

.4 Analog input (0-10V) for capacity control

.5 Digital Inputs for On/Off and Mode control

.6 Digital Outputs for ODU running status (heat/cool/off), ODU defrost signal

.7 Designed for indoor installation (field-supplied waterproof enclosure required for outdoor installation)

.8 Wired Remote Controller

.9 Electronic Expansion Valve Kit

.12 PERFORMANCE

.1 Refer to Schedule on drawings.

2.3 DRIERS

.1 Provide liquid line driers to AHRI 710, UL approved and rated to SWP-650 psig.

.2 Size as indicated, but not less than recommended by equipment manufacturer's nominal tonnage rating for type of refrigerant used.

.3 Size 16 mm outside diameter or larger: replaceable cartridge type and installed as indicated.

2.4 SIGHT GLASS

.1 Provide moisture indicating, double sight glass:

.1 Upstream from expansion valve.
.2 Elsewhere as indicated.

2.5 SOURCE QUALITY CONTROL

.1 Factory leak test air-cooled condenser coils: 650 psig minimum gauge pressure.

.2 Factory leak test evaporator coils to industry standards, 250 psig minimum gauge pressure.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts shall be acceptable for process cooling equipment installation in accordance with manufacturer's written instructions.

.2 Visually inspect substrate in presence of Contract Administrator.

.3 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.4 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.3 INSPECTION

.1 Upon delivery, inspect components for damage or gas loss and report to Contract Administrator in writing.

3.4 ACCESSIBILITY

.1 Provide clearance around equipment and components for observation of operation, inspection, service and maintenance without removal of any equipment, components or piping.

.2 Install access doors in equipment and ducts, and as necessary to provide accessibility.

3.5 INSTALLATION

.1 Provide appropriate protection apparatus.

.2 Install systems and related controls in accordance with reviewed shop drawings.

.3 Drains:

- .1 Install drains to permit removal of condensate and allow cleaning of coils.
- .2 Run drain lines to floor drains in accordance with Section 22 13 17 Drainage Waste and Vent Piping - Cast Iron and Copper.

.4 Locate vibration and noise isolation as indicated.

- .1 Where units shall be supplied with sound attenuator, conform to manufacturer's instructions.
- .2 Ensure adequate base or foundation.

.5 Install disconnect switch adjacent to each unit.

.6 Refer to Structural drawings for unit mounting details.

.7 Thermal expansion valves:

- .1 Mount thermal expansion valve bulb on suction line at evaporator outlet. If suction line rises after bulb, precede rise with P-trap.
- .2 Suction line to be horizontal, pitched for drainage from bulb location.
- .3 If suction line rises after bulb, precede rise with P-trap.
- .4 Connect external equalizer to suction line immediately downstream of thermal expansion valve bulb, midway on pipe diameter, to sense refrigerant liquid and gas.

.8 Accessories:

- .1 Install as indicated.

- .2 Standard:

.1 Ball check isolating valves at receiver sight glass.

.2 Charging valve for high and low side filter drier, solenoid valve and thermostatic expansion valve.

3.6 FIELD QUALITY CONTROL

.1 Pressure and leak testing:

.1 Test in accordance with Section 21 05 01 General Provisions – Mechanical.

3.7 CLEANING

.1 Reclaim refrigerant by pumping down through filtration system.

3.8 DEHYDRATION

.1 Carry out work in presence of Contract Administrator.

.2 Evacuate using two stage vacuum pump with gas ballast on second stage capable of pulling vacuum of 0.05 mm minimum.

.1 Fill pump with fresh dehydrated oil.

.3 Do not use refrigerant compressors to pull vacuum.

.4 Maintain ambient temperature of 13 degrees C minimum throughout refrigeration system for 12 hours minimum before and during dehydration.

.5 Connect high vacuum hose or seamless copper tubing jumper lines to both high and low pressure sides.

.1 Line size: 6 mm minimum nominal outside diameter for units up to 70 L internal volume and 12 mm minimum nominal outside diameter for larger units.

.6 Install thermo couple vacuum gauge to measure system pressure.

.1 Locate manual isolating valve between pump and gauge and take readings only with system isolated from pump.

.7 When compressor/condensing unit has refrigerant holding charge intact, service valves to remain closed during evacuation.

.1 Evacuate any equipment received with dry air, wrong refrigerant, or lost holding charge.

.8 Evacuate field installed system 3 times as follows: twice to 1.5 mm and hold for 4 hours minimum.

.1 Break vacuum to gauge pressure of 14 kPa each time with refrigerant.

.2 Continue pumping, for final evacuation, through 12 hours minimum after reaching 0.5 mm.

.3 After completion of final evacuation, isolate pump from system and make graphic record of rate of any increase in vacuum reading which may take place inside following hours.
.4 Continue readings until vacuum has stabilized.
.5 Provide Contract Administrator with 3 copies of graphic record.
.6 Charge through filter drier.
.7 Use receivers or other technology to contain CFC-13 or other ozone depleting refrigerant used for triple evacuation.
.8 If this shall be not possible, an alternative to triple evacuation such as vacuum evacuation should be employed.

3.9 CHARGING

.1 Give initial charge through high side charging valve with pressure gauge and new filter-drier installed in connection to charging valve.

.2 Charge only amount of refrigerant necessary for proper operation of refrigeration system.

.1 Close liquid charging valve when amount has been charged.
.2 Observe sight glass near receiver outlet, with system in operation, to recheck.

.3 Re-purge charging line, when refrigerant container must be changed during charging process.

.4 Permit low side charging only for charging small amounts in gaseous state.

.5 Provide 3 days notice of leak testing, dehydration and charging.

.6 Prime oil separator with operating charge of compressor oil.

3.10 START-UP AND ADJUSTMENT

.1 Provide necessary instruments, gauges and testing equipment required.

.1 Adjust controls, to obtain design requirements and manufacturer's ratings.

.2 Ensure that insulation of refrigerant piping and accessories completed.

.3 Test and record cooling apparatus entering and leaving air temperatures, dry bulb and wet bulb.

.4 Test and record voltage and running amperes and compare to motor nameplate data, and starter heater rating against design requirements.

.1 Check each phase which must be accurate to nearest 100 VA.

.5 Ensure that refrigerant temperatures shall be accurate to within 0.5 degrees C of design requirements.

.6 Set and adjust automatic control system to achieve required sequence of operations in co-operation with Contract Administrator.

.7 Bring equipment into operation, trial run and make up any loss of oil and refrigerant.

3.11 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by process cooling equipment installation.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for fan coil units.

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 21 05 01 General Provisions – Mechanical. Include product characteristics, performance criteria, and limitations.

.1 Product data to include:

.1 Filters, fan accessibility.

.2 Suspension or anchoring of cabinet.

.3 Physical size.

.4 Thermostat, transformer, controls where integral.

.5 Finish.

.6 kW rating voltage, phase.

.7 Cabinet material thickness.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 21 05 01 General Provisions – Mechanical.

.3 Quality assurance submittals:

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with manufacturer’s written instructions.

Part 2 PRODUCTS

2.1 DUCTED FAN COIL, FC

.1 General:

.1 Factory assembled, horizontal or vertical blow-thru ducted fan coil unit. Unit shall be complete with water coil(s), fan(s), motor(s), drain pan, and all required wiring, piping, controls and special features. Standard insulation shall be dual density fiberglass insulation.

.2 Unit shall be constructed of galvanized steel with removable panels for access to internal components. Units have $^{1}/_{2}$-in. fiberglass insulation, filter track with 1-in. throwaway filter, 1-in. supply collar, and 1-in. return-air collar on rear of unit for duct connection.

.2 Fans:

.1 Direct-driven, double-width fan wheels shall have forward-curved blades, and be statically and dynamically balanced, with scrolls and fans constructed of galvanized steel.

.3 Coils:

.1 Standard base unit shall be equipped with a 4-row coil for installation in a 2-pipe system. Additional coil depth and circuiting shall be provided for installation in a 4-pipe system as described in the Special Features section. All coils shall have $^{1}/_{2}$-in. copper tubes and aluminum fins (10 fins per inch) spacing; Coil fins are mechanical bonded to tube joints. The copper tubes comply with the ASTM (American Society for Testing and Materials) B-75. The fin thickness is 0.0045-in. and tube thickness is 0.016-inch. All coils shall be leak tested with air at 300 psig under water.

.4 Controls and Safeties:

.1 The fan motor(s) shall be equipped with integral, automatic reset thermal overload motor protection.

.5 Operating Characteristics:

.1 A single-circuit coil unit installed in a 2-pipe system shall be capable of providing heating or cooling as determined by the operating mode of the central water supply system. A double circuit coil unit installed in a 4-pipe system shall be capable of providing sequenced heating and cooling.

.6 Electrical Requirements:

.1 Standard unit shall operate on 115-v, single-phase, 60-Hz electric power, and all exposed wiring shall be in a flexible conduit.

.7 Motor(s):

.1 Fan motors shall be 3-speed permanent split capacitor type, 115 volts, permanently lubricated with sleeve bearings. Motor shall have thermal

overload protection with automatic reset and be connected with quick connect electrical plug.

.8 Special Features:

.1 Fan motor shall be constant torque electrically commutated type, 115, 208, 220, 240, or 277-v, single phase, 50 or 60 Hz as specified on the equipment schedule. The operating sequence shall be one of the following, as specified:

.1 Variable Airflow for 0 to 10 VDC / 4 to 20 mA Input. Requires a 0 to 10 VDC input signal and is not compatible with a 3-speed thermostat.

.2 Filter track and replaceable MERV 13 filter shall be installed in the plenum.

.3 Drain pan shall include a second drain connection located above the main drain connection to act as an indicator that the main drain is plugged.

.4 Removable drain pan extension (drip lip) shall be provided for field installation by the Contractor under electric water valves.

.5 A stainless steel drain pan shall be factory installed.

.9 Acceptable Product:

.1 Carrier 42DE or Approved Equal in accordance with frontend clause B6

.10 Performance:

.1 Refer to schedules on drawings.

2.2 WALL MOUNTED FAN COIL, FC

.1 Description:

.1 The support frame:

.1 Consisting of 19 gauge galvanised steel plate

.1 The unit is equipped with a condensation collecting tray and drain. Connect the drain to a frequently used drainpipe with a P-trap.

.2 Insulation to avoid the formation of condensation and to reduce noise

.2 Dynamic Heat Exchanger:

.1 Round, seamless circular pipes in pure copper, connected to pure aluminium fins with 11 fins per inch included a brass connector, including air venting

.1 Element pressure test: 362.5 PSI

.2 Operating pressure: max 174 PSI

.3 Coil connection 3/4” NPT

.4 Standard connection left, right hand connection only on demand

.3 EC Fan:

.1 Extremely silent tangential fans with aluminium fins, inserted in EPDM vibration-reduction, with ball bearing support

.1 Programmable 24 VDC EC motor with 0...10 V stepless control and stainless steel filter

.2 Extreme low power consumption (max. 26 Watt)

.3 Noise reduction: resin-coated winding in EPDM vibration damping

.4 Electrical Connection

.1 Standard on the RHS Power supply

.1 36W , 60W, 100W

.5 Casing:

.1 Front:

.1 Electrolytic, galvanized steel plate of 1.25 mm thick.

.2 Side panels:

.1 Galvanized steel plate of 1.25 mm thick.

.3 The casing is lacquered in the colour white (RAL 9010) / traffic white (RAL 9016) / sandblast grey metallic 001 / other colour structured finish at extra charge.

.4 Aluminium top grille coated in the same colour as the casing.

.5 Coating:

.1 A scratch resistant epoxy-polyester powder, sprayed electrostatically and baked at a temperature of 200°C. UV resistant due to ASTM G53.

.6 The surface temperature remains safe at all times, even at a water temperature of 90°C (194F).

.2 Operating limits:

.3 Minimum installation height

.1 The minimum distance between the bottom of the panel and the floor is at least 3.94”

.2 Top discharge of the unit is 5.91”

.4 Options:

.1 On - Off controller, for use with 0...10V Building Management

.5 Performance:

.1 Refer to Schedule on drawings.

.6 Approved Product:

.1 Jaga Briza 22 or Approved Equal in accordance with frontend clause B6.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install fan-coil units level and plumb.

.2 Suspend fan-coil units from structure with hangers and rubber grommets for vibration isolation.

.3 Make power and control connections.

3.3 CLEANING

.1 Proceed in accordance with Section 21 05 01 General Provisions – Mechanical.

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for forced air heaters and include product characteristics, performance criteria, physical size, finish and limitations.

.1 Product data to include:

.2 Replacement data for motor element, thermostat and switch.

.3 Mounting methods.

.4 kW rating, voltage, phase.

.5 Cabinet material thicknesses.

.6 Physical size.

.7 Finish.

.8 Thermostat, transformer, controls where integral.

.2 Manufacturer’s Instructions: provide to indicate special handling criteria, installation sequence and cleaning procedures.

1.2 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Operation and Maintenance Data: submit operation and maintenance data for forced air heaters for incorporation into manual.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer’s instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer’s name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, indoors and in dry location in accordance with manufacturer’s instructions in clean, dry, well-ventilated area.

.2 Store and protect equipment from nicks, scratches, and blemishes

.3 Replace defective or damaged materials with new.

Part 2 PRODUCTS

2.1 SLOPED TOP FLOOR MOUNTED HYDRONIC FORCED AIR HEATERS, FF

.1 The Cabinet Unit Heaters will conform to the items listed below and be certified under CSA guidelines.

.2 CABINETS

.1 All cabinets will be constructed with 18-gauge cold rolled steel, side panels and top. The front panel shall be furnished in 16-gauge cold rolled steel. It will have 1/2", 1-1/2 pound insulation with one side neoprene coated in front of coil. The internal cabinet shall be furnished in 18-gauge galvanized steel. Adequate work area for installation of control valves or electrical equipment shall be provided on both sides of the internal cabinet.

.2 The cabinet shall be provided with powder coated baked enamel, color selected from standard.

.3 All cabinets shall be supplied with adjustable rear mounting brackets which will provide adjustment to correct alignment of the unit at installation to non square or out of true walls, joists, studs or surfaces. Adjustable leveling legs (two each base leg) shall be supplied.

.3 FILTERS

.1 All filters supplied as standard shall be reusable aluminum media with a 69% arrestance level. Filters shall be slide in type which are locked into position with a cotter pin.

.4 FANS

.1 Fan wheels shall be centrifugal, forward curved, double width. Fan housings shall be of formed galvanized sheet metal.

.5 COILS

.1 This is a hot water coil designed to provide increased capacity when the required load exceeds that of the standard coil for a given size. Its construction is similar to the standard coil however, there are two rows of tubes. Element assemblies are submersion tested at 250 PSI and are rated at a working pressure of 300 PSI.

.6 MOTORS

.1 Standard PSC motors shall have integral thermal protection and start at 78% of rated voltage. All motors shall be factory run-tested and assembled in unit prior to shipping. All motors shall be factory run-tested and assembled in unit prior to shipping.

.7 ELECTRICAL

.1 All primary internal wiring shall be done at the factory and every unit shall be factory tested for reliability

.8 PERFORMANCE

.1 Refer to schedules on drawings.

2.2 CEILING MOUNTED HYDRONIC FORCE FLOW HEATERS

.1 Pre-assembled fancoil unit, with enclosure suitable ceiling installation.

.2 2- pipe connection heating.

.3 The support frame:

.1 Consisting of 19 gauge galvanised steel sheet
.2 The unit is equipped with a condensate tray and drain. Connect the drain to a frequently used drainpipe with a P-trap.
.3 Insulation to avoid condensation and to reduce noise

.4 Dynamic Heat Exchanger:

.1 Round, seamless circular pipes in pure copper, connected to pure aluminium fins with 11 fins per inch included a brass connector, including air venting
.2 Element pressure test: 377 PSI
.3 Operating pressure: max 290 PSI
.4 Coil connection 3/4” NPT
.5 Standard connection left, right hand connection only on request, Contractor to verify prior to ordering.

.5 EC Fan:

.1 Quiet tangential fans with aluminium fins, inserted in EPDM vibration-reduction, with ball bearing support
.2 24 VDCEC motor with 0...10 V stepless control and stainless steel protection screen • extreme low power consumption (max. 24 Watt)
.3 Noise reduction: resin-coated winding in EPDM vibration damping

.6 Electrical Connection

.1 Standard on the RHS

.7 Power supply

.1 25 W

.8 Operating limits:

.1 Supply water temperature: 38°F> 190°F
.2 Maximum pressure heat exchanger: 116 PSI
.3 Supply Voltage: 24 VDC
.4 Max counterpressure: 30Pa 0.12”

.9 Performance:

.1 Refer to Schedule on drawings.

.10 Acceptable Product:

.1 Jaga Briza EC 12 BZMC or Approved Equal in accordance with frontend clause B6.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Install heaters in accordance with manufacturer's instructions.

.2 Provide all cutting and patching required to install forced air heaters.

.3 Make power and control connections.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 23 09 33 Electric & Electronic Control Systems for HVAC.

3.3 CLEANING

.1 Clean in accordance with Section 21 05 01 General Provisions – Mechanical.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by forced air heaters installation.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Baseboard and finned tube radiation, and cabinet convectors including installation.

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS),

.1 Material Safety Data Sheets (MSDS),

.2 Hydronic Institute of Boiler and Radiator Manufacturers (IBR).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specification and data sheet in accordance with Section 21 05 01 General Provisions – Mechanical. Include product characteristics, performance, criteria and limitations.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Indicate:

.1 Equipment, capacity, piping and connections,

.2 Dimensions, internal and external construction details, recommended methods of installation with proposed structural steel support, sizes and location of mounting bolt holes

.3 Quality assurance submittals:

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics.

.2 Instructions: submit manufacturer's installation instructions.

.4 Closeout Submittals:

.1 Submit maintenance data for incorporation into manual specified in Section 21 05 01 General Provisions – Mechanical.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading: Deliver, store and handle in accordance with manufacturer's written instructions.

Part 2 PRODUCTS

2.1 FINNED TUBE RADIATION, WF-1:

.1 Copper-aluminum element shall be nominal seamless copper with aluminum fin. Fins to be stamped for rigidity and have integral collars to provide even spacing and maximum heat transfer. Tube ends suitable for sweat connecting. Heavy gauge element hangers shall be provided for mounting on the enclosure bracket and shall consist of rigid galvanized steel hanger with pegboard style mounting hook and nylon roller bearing to allow for free expansion. Center on minimum 4 ft. (1.2m).

.2 Brackets shall be formed of 14 gauge (1.6 mm) satin coat galvanized steel for rigidity and shall support the element hangers and the front of the enclosure.

.3 Performance:

.1 See Equipment Schedules on drawings.

.4 Thermostat to be provided by controls Contractor

.5 Approved Manufacturer: Vulcan or Approved Equal in accordance with frontend clause B6.

.1 Approved Equals: Engineered Air, Sterling, Zehnder Rittling

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Install in accordance with piping layout and approved shop drawings.

.3 Provide for pipe movement during normal operation.

.4 Maintain sufficient clearance to permit performance of service maintenance.

.5 Check final location with Contract Administrator if different from that indicated prior to installation. Should deviations beyond allowable clearances arise, request and follow Contract Administrator's directive.

.6 Valves:

.1 Install valves with stems upright or horizontal unless approved otherwise.
.2 Install isolating valves on inlet and outlet, and balancing valves on outlet.

.7 Venting:

.1 Install manual air vent on cabinet convector, terminating flush with surface of cabinet.
.2 Install automatic air vents on continuous finned tube radiation.

.8 Clean finned tubes and comb straight once installation is complete.

3.3 CLEANING

.1 Proceed in accordance with Section 21 05 01 General Provisions – Mechanical.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 ASTM International

.1 ASTM E 84, Standard Test Method for Surface Burning Characteristics of Building Materials.
.2 ASTM C 916, Standard Specification for Adhesives for Duct Thermal Insulation.
.3 ASTM C 1071, Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).

.2 National Fire Protection Association (NFPA)

.1 NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.
.2 NFPA 90B, Standard for the Installation of Warm Air Heating and Air Conditioning Systems (ANSI).

.3 Underwriters' Laboratories (UL) Inc.

.1 UL 2021, Fixed and Location-Dedicated Electric Room Heaters.

*** All Codes and Standards are to the latest editions ***

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 21 05 01.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for unit heaters and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, cleaning procedures.

.4 Shop Drawings:

.1 Submit drawings stamped and signed by professional Contract Administrator registered or licensed in Province of Manitoba, Canada.
.2 Indicate on drawings:
.1 Equipment, capacity and piping connections.
.2 Dimensions, internal and external construction details, recommended method of installation with proposed support, sizes and location of mounting bolt holes.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 21 05 01.

.2 Operation and Maintenance Data: submit operation and maintenance data for unit heaters for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 21 05 01 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labeled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect unit heaters from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

Part 2 PRODUCTS

2.1 GENERAL

.1 Furnish and install Unit Heaters where indicated on the drawings and in the specifications, with required mounting components and accessories. All units shall be capable of meeting or exceeding the scheduled capacities for heating and air delivery. Units shall be ETL certified for the United States and Canada in compliance with UL/ANSI Standard 1995 and CSA C22.2 No. 236-95.

.2 Performance: See Equipment Schedule

.3 Control: See Specification Section 23 09 33 – Controls.

.4 Approved Product: Vulcan model HV or Approved Equal in accordance with frontend clause B6.

.5 Approved Equal: Engineered Air, Sigma, Sterling, Trane, Zehnder Rittling Vulcan equivalent

2.2 DESCRIPTION

.1 An assembly including casing, coil, fan, and motor in [vertical] [and] [horizontal] discharge configuration with adjustable discharge louvers.

.2 Comply with UL 2021.

.3 Comply with UL 823.

2.3 CABINET

.1 All units shall have panels fabricated of not less than 18 gauge cold rolled steel.

.2 Horizontal Units:

.1 Casing consists of top/back and side halves. Both halves are joined on top and back with hex head screws.
.2 Top casing is furnished with threaded hanger connections for suspension of unit.
.3 Fan venturi is die-formed on back half.
.4 Units shall be equipped with horizontal, individually adjustable louvers.

2.4 CABINET FINISH

.1 All painted cabinet exterior panels shall be finished with a standard textured gray epoxy powder coat paint.

2.5 AIRSTREAM SURFACES

.1 Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2019.

2.6 GENERAL COIL REQUIREMENTS

.1 Test and rate hot-water propeller unit heater coils according to ASHRAE 33.

2.7 HOT-WATER/STEAM COIL

.1 Designed for either two-pipe steam or hot water heating system.

.1 Coils shall have ½" nominal diameter seamless copper tubes and shall be mechanically expanded to provide an efficient, permanent bond between the tube and integral collar of the aluminum fin.
.2 Minimum copper tube thickness shall be 0.028".
.3 Fins shall be die-formed and have a high efficiency aluminum surface optimized for heat transfer, air pressure drop and carryover.
.4 Minimum fin thickness shall be 0.010".
.5 Lanced fins shall not be acceptable.
.6 Fins are continuous across width and depth of coil and are vertically oriented to resist collection of dirt and foreign particles.
.7 Coils are of non-ferrous construction and serpentine design for RH-18 and RH-24. All other units incorporate brazed steel header tubes.
.8 RH-18 through RH-86 units have ¾" female threaded NPT, brass header connections while all other units have male threaded NPT connections.

.9 All coils shall be tested at 275 PSIG air pressure under water, and rated for a maximum 220 PSIG water or 150 PSIG steam and 375°F.

.10 Coils have CRN pressure vessel certification for Manitoba.

2.8 FAN

.1 Propeller type with non-conducting, spark-proof aluminum blade wheel with steel hub directly mounted on motor shaft in the fan venturi.

2.9 FAN GUARD

.1 Shall be finger-proof, constructed of welded steel rod and finished with a standard black epoxy powder coat paint. Units mounted below 8 feet from the floor must be equipped with an OSHA fan guard to meet ETL and OSHA requirements.

2.10 FAN MOTORS

.1 Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

.1 Motor Type: Permanently lubricated, two-speed, permanent split capacitor, totally enclosed with automatic reset integral thermal overload protection (3-phase motors require field supplied motor overload protection), designed to handle up to 104°F maximum constant ambient temperature. Shaded pole motors are not acceptable. Single speed motors are not acceptable.

2.11 CONTROL DEVICES

.1 Fan motor contact, hydronic control valve and thermostat provided by Controls Contractor, refer to Section 23 09 33.

2.12 ELECTRICAL CONNECTION

.1 Factory wire motors and controls for a single electrical connection.

.2 Provide a service disconnect switch to isolate power from the unit during maintenance.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Include double swing pipe joints as indicated.

.3 Check final location Contract Administrator if different from that indicated prior to installation.

.1 Should deviations beyond allowable clearances arise, request and follow Contract Administrator's directive.

.4 Hot water units: for each unit, install ball isolation valves on inlet and balancing valve on outlet of each unit. Install drain valve at low point.

.1 Install manual air vent at high point.

.5 Clean finned tubes and comb straight.

.6 Provide supplementary suspension steel as required.

.7 Install thermostats in locations indicated.

.8 Before acceptance, set discharge patterns and fan speeds to suit requirements.

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with Section 21 05 01.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 21 05 01.

3.3 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by unit heaters installation.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Division 00 – Bidding & Contract Requirements

.2 General Requirements

.3 All Electrical Drawings and Division 26, 27 and 28 Series Specification Sections.

1.2 QUALITY ASSURANCE

.1 Do complete installations in accordance with CSA C22.1.

.2 While not identified and specified by number in this Division, comply with CSA Electrical Bulletins in force at time of tender submission. Comply with the requirements of all Provincial and local laws, rules, ordinances and codes.

.3 Electrical installation shall be in accordance with the current edition of the Canadian Electrical Code, Provincial and other codes, rules and regulations. Supply material and labour required to meet the requirements of these codes, rules and regulations even though the work is not shown on the drawings or mentioned in the specifications. Where the electrical installation calls for better quality materials or construction than the minimum requirements of these codes, rules and regulations, the electrical installation shall be as shown on the drawings and as specified.

.4 Electrical installation shall be in accordance with the requirements of the electrical supply authority and local inspection authority.

1.3 PERMITS, FEES

.1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Obtain all necessary permits required for the electrical installation.

.3 Pay all fees for permits and inspections as required for the electrical installation.

1.4 MATERIALS AND EQUIPMENT

.1 Provide labour, materials, transportation, equipment and facilities, etc., required for the complete electrical installation as indicated or implied on the drawings and specifications.

.2 Electrical equipment shall be new and of type and quality specified.

.3 Equipment and material shall be CSA certified, and manufactured to standards described. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from the appropriate Inspection Departments.

.4 Request for approval of material, as equal, shall conform to Section 26 00 10.1.16.4 herein.

1.5 SUBMITTALS

.1 Submit shop drawings and product data for review by the Consultant. All drawings shall be in English and Imperial dimensions or in metric where indicated. Manufacture of equipment shall not commence until shop drawings have been reviewed. Shop drawings shall be submitted electronically. The MCW shop drawing email address for electrical submission is wpg.shopdrawings@mcw.com. Shop drawings shall be reviewed prior to submittal to Consultant, confirming that they meet all the design requirements. Mark up and sign Contractor approval on the drawings.

.2 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.

.3 Where applicable, include wiring, single line and schematic diagrams.

.4 Include wiring drawings or diagrams showing inter-connection with work of other sections.

.5 Submit samples in accordance with General Conditions. Samples shall be forwarded to the Consultant's office. Approved samples will be retained until after tender closing, then all samples will be returned except for the sample submitted by the Manufacturer who has been listed by the successful Contractor in the tender documents. This sample will be used for comparison with the actual production run of successful manufacturer.

.6 Submit shop drawings of service entrance equipment to utilities.

.7 Material submitted for Consultant's review shall bear Contractor's, and where applicable, Utility reviewed stamp.

1.6 OPERATIONS AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into Maintenance Manuals.

.2 Include details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.

.3 Include technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature not acceptable.

.4 Include wiring and schematic diagrams and performance curves.

.5 Include names and addresses of local suppliers for items included in Maintenance Manuals.

.6 Submit Maintenance Manuals electronically to the Consultant for review. Manuals that are incomplete shall be returned to the Electrical Sub-Contractor for completion. Completed manuals shall be submitted, to the satisfaction of the Consultant, before final payment may be considered to be due.

1.7 MAINTENANCE MANUALS

.1 Provide maintenance materials as specified.

.2 Turn materials over to The city in an orderly fashion upon completion of installation.

.3 Include electronic pdf copy, one (1) USB flash drive and three (3) hard copy binders.

1.8 VOLTAGE RATINGS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electrical heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment shall operate in extreme operating conditions established in above standard without damage to equipment.

1.9 INSPECTION

.1 Furnish a Certificate of Acceptance from the Inspection Authorities on completion of work. Copies of certificate shall be included in Maintenance Manuals.

.2 Certificate of Inspection of Approval shall be submitted before final payment may be considered to be due.

.3 During the course of the project construction, the Consultant will carry out periodic site reviews and prepare a deficiency list for remedial action by the Electrical Subcontractor. The Electrical Subcontractor shall respond in writing to the Consultant, stating corrective action and completion date for each item listed as deficient. This response shall be in the hands of the Consultant within three working days of receipt of the Inspection Report.

1.10 CARE, OPERATION AND START-UP

.1 Instruct The city's operating personnel in the operation, care and maintenance of equipment. Arrangement of such instructional sessions shall be done at a time convenient to The city.

.2 Arrange and pay for services of Manufacturer's factory service Contract Administrator to supervise start-up of installation, check, adjust, balance and calibrate components.

.3 Provide these services for such a period, and for as many visits as necessary to put equipment into operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.11 FINISHES

.1 Paint indoor switchgear and distribution enclosures light grey to EEMAC-2Y-1.

.2 Clean and touch up surfaces of shop-painted equipment, scratched or marred during shipment or installation, to match original paint.

.3 Clean, prime and paint exposed hangers, racks, fastenings to prevent rusting.

1.12 EQUIPMENT IDENTIFICATION

.1 Equipment identification applies to: electrical distribution, mechanical equipment including starters, heaters, control panels, disconnects, transformers and other similar devices.

.2 Provide lamacoid nameplates, 1/8” (3mm) thick plastic engraving sheet, black or red face, white core, mechanically attached (screwed or riveted) unless specified otherwise. Sizes as follows:

Size 0	3.8” x 1 1/2”	(10 x 38 mm)	1 line	1/8”	(3mm) high letters
Size 1	3/8” x 4”	(10 x 100mm)	1 line	1/8”	(3 mm) high letters
Size 2	1/2" x 3”	(13 x 75mm)	1 line	3/16”	(5 mm) high letters
Size 3	1/2" x 3”	(13 x 75mm)	2 lines	1/8”	(3 mm) high letters
Size 4	3/4" x 3”	(19 x 75mm)	1 line	3/8”	(10mm) high letters
Size 5	3/4" x 4”	(19 x 100mm)	2 lines	3/16”	(5 mm) high letters
Size 6	1” x 4”	(25 x 100mm)	1 line	1/2”	(13mm) high letters
Size 7	1” x 4”	(25 x 100mm)	2 lines	1/4"	(6 mm) high letters

.3 Wording on nameplates shall be approved by the Consultant prior to manufacture. Submit schedule of nameplates and wording.

.4 Allow for average of twenty-five (25) letters per nameplate.

.5 Lamacoids shall include the following information in this format:

EQUIPMENT IDENTIFICATION

AMPACITY (IF APPLICABLE)

VOLTAGE/PHASE

<FED FROM PANEL> OR <BRANCH CIRCUIT NUMBER>

.6 Identification shall be English.

.7 Nameplates for terminal cabinets and junction boxes shall indicate system and/or voltage characteristics.

.8 Use black nameplates with white lettering for normal power and communications equipment. Use red nameplates with white lettering for emergency power and fire alarm equipment.

1.13 WIRING DEVICE IDENTIFICATION

.1 Wiring devices apply to receptacles, switches, baseboard or force-flow heaters, door operators, emergency lighting and similar devices.

.2 Identify wiring devices with size Ø nameplate indicating panel and circuit number. Nameplates to be pre-glued with peel-off paper backing.

1.14 PROJECT RECORD DOCUMENTS

.1 Electrical Subcontractor shall maintain accurate Project Record Drawings (Red-Line Markups) on site while project is under construction. These documents shall be available and presented for review at any time during the Contract Administrator site review.

.2 Project Record Drawings shall include all changes in the Contract documents as per Change order (CO), Change Directive (CD) Supplemental or Job Instructions (SI)(JI) and all changes to mechanical, electrical, architectural, structural floor plans and civil drawings as well as all addenda items.

.3 The Electrical Subcontractor shall be responsible for the production of the Project Record Drawings which shall provide a complete and accurate detailed record of the actual Electrical installation. Record “as-built” information in red ink, accurately and concurrently with construction progress.
Electrical Record Drawings shall include:

1. Circuiting of all new and existing equipment to remain
2. Location of all feeder cables, conduit routing, conduit sizes, junction box locations and branch wiring drops
3. Dimensions and locations of all underground or in or under slab conduits/feeders
4. Distribution and Panel identification labels
5. Fire alarm device addresses
6. ME Schedules shall include updates to all equipment, motors, wiring, breaker sizes based on final equipment selections

.4 Any relocated or added equipment shall be identified.

.5 The use of white out (liquid or tape) shall only be used for correcting Contractor red line errors only. Do not use white out to delete original Contract drawings deleted items shall be crossed out in red ink

.6 The Electrical Subcontractor shall neatly transfer all “as-built” notations to a clean set of drawings, affix their company name, contact information, signed, dated and the words “Project Record Drawings” on each page of the drawing set.

.7 Submit electronic copy to Contract Administrator for preliminary review prior to request for Substantial Performance.

.8 Record Drawings that are incomplete shall be returned to the Electrical Subcontractor for remedial measures. The Consultant shall recommend a suitable deficiency holdback until such time as the Record Drawings are submitted in the acceptable form.

.9 A minimum of $1,000.00 per drawing may be held back until all Project Record Drawings are submitted and deemed complete.

.10 Project Record Drawings shall be transferred to electronic AutoCAD file in latest version and labelled as “Project Record Drawings”.

.11 Upon review and acceptance of preliminary Project Record Drawings by the Consultant, final Record Document Package shall consists of one (1) complete set of AutoCAD and PDF Record Documents submitted electronically to consultant. In addition submittal shall include one (1) USB drive, one (1) set of Project Record Drawing prints and one (1) set of the c Contractors on site Red-Line Drawing Markups. These documents will be reviewed and submitted to The city for their use.

.12 MCW Consultants Ltd. can complete the Auto Cad Project Record Document reproduction from the Contractor’s red-lined markups for a fee of $350.00 per drawing sheet with a project minimum of $1,000.00

.13 Substantial Performance will not be attained until the Project Record Drawings are received and accepted as complete by the Consultant.

1.15 DEFINITIONS

.1 The following are definitions of terms and expressions used in the specification:

- .1 CONSULTANT means Electrical Engineering Consultant: MCW Consultants Ltd
- .2 INSPECTION AUTHORITY means agent of any authority having jurisdiction over construction standards associated with any part of electrical work on site.
- .3 SUPPLY AUTHORITY means electrical power utility company responsible for delivery of electrical power to project.
- .4 ELECTRICAL CODE means as shown on Contract drawings or noted in Contract Documents.
- .5 TYPE TESTED means that each piece of equipment produced by Manufacturer is not fully tested. An original piece with similar arrangement has been fully tested and results of that test are available.
- .6 PROVIDE means to supply, install and leave in working order all materials and necessary wiring, supports, access panels, etc., as necessary for equipment indicated.

1.16 LABELS AND WARNING SIGNS

.1 Manufacturer's nameplates and CSA labels shall be visible and legible after equipment is installed.

.2 Provide warning signs on equipment, as required, to meet the requirements of the Inspection Authorities, including indication of multiple power sources.

1.17 EQUIVALENT MATERIALS AND EQUIPMENT

.1 Bidders shall submit a tender based on the specified materials and equipment only.

.2 Bidders may submit a tender based on equivalent materials and equipment only if such items have been approved as equals by the Consultant.

.3 Bidders may submit, with their tender, an alternate price based on alternate materials and equipment only if such items have been approved as alternates by the Consultant.

.4 Submissions for equals or alternates shall be received by the Consultant five (5) working days prior to tender closing. Submissions shall include sufficient Manufacturer's data to clearly show equivalency, as well as an itemized list of equal or alternate items, the items for which they were submitted and a space for the Consultant to indicate 'approved equal', 'approved alternate', or 'not approved'.

.5 All submissions shall include the following phrase "We have reviewed all Contract documents, Contract drawings and specifications relating to the equipment presented herein" and must bear the name and signature of the Manufacturer or his agent.

1.18 LOCATION OF OUTLETS

.1 Locate outlets as indicated

.2 Do not install outlets back-to-back in wall; allow minimum 16" (400 mm) horizontal clearance between boxes.

.3 Drawings are schematic only and do not indicate all architectural or structural elements.

.4 Change location of outlets at no extra cost or credit, providing distance does not exceed 10'-0" (3 m) and information is provided before installation.

.5 Locate light switches on latch side of doors.

.6 Vertically align outlets of different systems when shown in close proximity to each other and occurring at different mounting heights.

.7 Coordinate mounting heights and location of all equipment with Architectural, Mechanical and Structural Drawings prior to installation of rough-in boxes.

.8 Cut in and recess outlet boxes in existing walls including cutting into block walls for flush finish.

1.19 MOUNTING

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicate otherwise.

.2 Mounting height of equipment shall be as per Architectural clarifications. Where elevations are not indicated, the following shall apply:

.1 Outlets above counters: (6") 150mm; splashbacks: 100mm.

.2 General receptacles, telephone and television outlets: 500mm.

.3 Receptacles in mechanical and shop areas: 1025mm.

.4 Switches, dimmers: (45") 1150mm.

.5 Door actuator push buttons: Refer to architectural elevations.

.6 Fire alarm pullstations: (45") 1150mm.

.7 End of line resistors: (64") 1625mm.

.8 Fire alarm visual, audible, and combination devices:

.1 (92") 2350mm or,

.2 (6") 150mm below ceiling measured from top edge of device where mounting height will be lower than (92") 2350mm.

.9 Intercom stations, keypads: (45") 1150mm (LCD/Video display T.B.C.).

.10 Thermostats: (45") 1150mm.

.11 Electric hand driers: (42") 1075mm. (Confirm with Contract Administrator and Manufacturer recommendations).

.12 Card readers, panic switches: (45") 1150mm.

.13 Branch circuit panels, control panels, annunciators, etc.: (72") 1825mm. To top of panel.

.14 Clock outlets: (92") 2350mm.

.15 Emergency battery units: (98") 2500mm.

.16 Emergency remote heads: (92") 2350mm.

.17 Exit signage: (92") 2350mm.

.3 Refer to accessibility design standards.

.4 All transformers, motor control centres and floor-mounted distribution panels shall be mounted on 4" (100 mm) concrete housekeeping pads. The Electrical Subcontractor shall be responsible for provision of these pads. Where ceiling heights will not allow housekeeping pads to be installed below distributions, and where pre-approved by the Consultant, 1 ½" (38mm) galvanized cantruss shall be provided in place of the pad.

1.20 PROTECTION

.1 Protect exposed live equipment during construction for personnel safety.

.2 Shield and mark live parts "LIVE ( ) VOLTS", with appropriate voltage in English.

.3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision.

.4 Provide wire guards for all electrical equipment in Gymnasium or areas subject to damage.

1.21 LOAD BALANCE

.1 Measure phase current to panelboards with normal loads operating at time of measurement. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Submit, at completion of work, a report listing phase and neutral currents on panelboards, transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

.4 Include load balance and voltage test results.

1.22 CONDUIT SLEEVES AND HOLES

.1 Install conduit, and sleeves, prior to pouring of concrete. Sleeves through concrete shall be sized for free passage of conduit.

.2 Holes through exterior walls and roof shall be flashed and made weatherproof.

.3 Make necessary arrangements for cutting of chases, drilling of holes and other structural work required to install electrical conduits, cables, pullboxes and outlet boxes.

.4 Install cables, conduits, and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

.5 Contractor shall scan structure before making openings and advise Contractor and consultant of any obstructions found prior to cutting or coring. Scan shall be completed prior to ordering material to be installed in or through concrete to ensure proper fit.

1.23 FIREPROOFING

.1 Where cables or conduits pass through floors, block or concrete walls and fire-rated walls, seal openings with fire-stopping material with intumescent properties.

.2 Fire proofing of electrical cables, conduits, trays, etc, passing through fire barriers shall conform to local codes and inspection authorities.

.3 Fire stop materials shall be asbestos free and have been tested in accordance with ASTM E-84, E-136 and E-814 and UC-1479.

.4 Fire stop and smoke seals shall be done in accordance with Section 07 84 00.

.5 Seal all penetrations upon completion of demolition

.6 Approved Manufacturer Spec seal

1.24 TESTS

.1 Conduct and pay for tests including, but not limited to, the following systems:

.1 distribution system.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Systems: Fire alarm, voice communication, intercom, P.A., etc. as applicable.

.6 Grounding systems.

.7 Local area network systems.

.8 Heat trace and heating mats.

.2 Furnish Manufacturer's Certificate or letter confirming that entire installation, as it pertains to each system, has been installed to Manufacturer's instructions. Submit letter in accordance with Section 26 00 10.1.39.3.

.3 Carry out tests in presence of Consultant where directed.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.5 Submit test results in Maintenance Manuals.

1.25 INSULATION RESISTANCE TESTING

.1 Megger circuits, feeders and equipment up to 350V with a 500V instrument.

.2 Megger 350-600V circuits, feeders and equipment with a 1000V instrument.

.3 Check resistance to ground before energizing.

1.26 CLEANING

.1 Do final cleaning in accordance with Section 01 74 00.

.2 At time of final cleaning, clean lighting reflectors, lenses, and other lighting surfaces that have been exposed to construction dust and dirt.

1.27 DELIVERY STORAGE AND HANDLING

.1 Deliver all materials to site in an orderly fashion.

.2 Store all materials in a clean and dry place, secure from vandalism or theft. All materials shall be left in shipping containers until required for use.

.3 Provide additional protection such as tarps, padding, wood skids, etc., where such is required to ensure protection of equipment and as directed by the Contract Administrator.

1.28 COORDINATION WITH OTHER TRADES

.1 Refer to Mechanical, Structural, Architectural and Interior Design drawings and specifications for additional electrical work in connection with other Divisions. Where such work is included in other sections of the specifications, provide equipment, conduit, wiring, etc. (in accordance with the Manufacturer's approved shop drawings), as required, for operation of the specified equipment.

.2 Schedule execution of electrical work with associated work specified in other Divisions.

.3 Coordinate electrical work with work of other trades to avoid conflicts with pipes, air ducts or other equipment. Provide additional supports, wiring, etc. to relocate electrical equipment, as required, where structural members, air ducts, piping or other equipment interferes with the electrical installation.

1.29 EXAMINATION OF SITE AND CONSTRUCTION DOCUMENTS

.1 Prior to submitting a tender, examine the site and local conditions which will affect the work. Refer to the Architectural, Mechanical and Structural drawings, schedules and specifications for construction details to be certain that the electrical work can be satisfactorily carried out as specified. Claims for extra payments, resulting from conditions, which could reasonably be foreseen during an examination of the documents and/or site, will not be recognized.

.2 Ensure that all equipment designated as "Existing to Remain" or "Existing to be Relocated" is suitable for its intended re-use, including panelboards and circuits. Report any discrepancies to the Consultant BEFORE close.

.3 Refer to General Conditions for instructions regarding a pre-arranged site visit during the tender period.

1.30 EXCAVATION AND BACKFILLING

.1 Excavate and backfill as required for underground electrical services as indicated. Provide protective materials around and over services and be present at all times during excavation and backfilling to supervise work. Backfilling shall restore the excavated area to the original condition and shall include sodding where required.

.2 Work shall be in accordance with the current CSA Bulletin.

.3 Include all costs for excavation and backfilling, for any underground electrical installation, unless otherwise indicated.

1.31 CUTTING AND PATCHING

.1 Pay the costs of all cutting and patching required for the installation of electrical work. Payment for cutting and patching shall be made through the Contractor.

.2 Cutting and patching required for the installation of electrical work shall be done by the particular trade whose work is involved. No cutting or patching shall be carried out by the tradesman employed on the electrical work.

.3 Obtain the approval of the Contract Administrator and/or The city before arranging for any cutting. Patching shall restore the affected area to the original condition; materials and methods used for patching shall be in accordance with the requirements of the corresponding Divisions of the specification.

1.32 WORKMANSHIP

.1 Install equipment, conduit and cables in a workmanlike manner to present a neat appearance to the satisfaction of the Consultant. Install conduit and cable runs parallel and perpendicular to building lines in chases, behind furring or above ceilings, where such concealment is possible. In areas where systems are shall be exposed, install neatly and group in a tidy appearance.

.2 Include, in the work, all requirements shown on the shop drawings or Manufacturer's installation instructions.

.3 Replace work unsatisfactory to the Consultant without extra cost.

1.33 ACCESS DOORS

.1 Access doors shall be a minimum #12 gauge prime coat painted bonderized steel. Each shall be complete with a heavy flush frame and anchor, concealed hinges, positive locking screwdriver lock, and mounting and finishing provisions to suit the finish material for which they are supplied. Access doors in fire rated ceilings, walls, partitions, structures, etc. shall be U.L.C. listed and labelled and of a rating to maintain the fire separation integrity.

.2 Where access doors are located in surfaces where special finishes are required, they shall be of a recessed door type capable of accepting the finish in which they are to be installed so as to maintain the fire separation integrity.

.3 Supply access doors in inaccessible construction shall give access to all concealed junction boxes, pullboxes, conductor joints and other similar electrical work which may need maintenance or repair.

.4 Before commencing installation of electrical work submit, to the Contract Administrator for approval, a list of required access doors showing the exact sizes and locations of such access doors. Locate access doors in walls and partitions to the Contract Administrator's approval, and arrange electrical work to suit. Access doors shall be, wherever possible, of a standard size for all application. Confirm exact dimensions with the Contract Administrator, prior to ordering.

.5 Access doors shall be installed by the Division responsible for the particular type of construction in which access doors are required. Supply the access doors to the Division installing same at the proper time to avoid construction delays.

1.34 SPARE PARTS

.1 Assemble spare parts as specified:

.2 Include the following:

.1 Part number.

.2 Identification of equipment or system for which parts applicable.

.3 Installation instructions as applicable.

.3 Provide a written list complete with The city's signature assuring that spare parts have been received by The city.

1.35 UNIT PRICES

.1 Each unit price shall include all labour, materials, products, equipment, services, and respective overhead, profit, taxes and disbursement and related charges and represent the actual cost or credit to the city.

1.36 PRICING OF CHANGES AFTER TENDER

.1 The Electrical Subcontractor shall submit, with his tender, an hourly rate for:

.1 Foreman

.2 Journeyman

.2 For changes made after award of Contract. This shall include all overhead, vacation pay, contributions, etc. for a complete hourly rate. The Contractor shall sign and date this submission, and a copy shall be submitted to the Consultant;.

.3 The rates submitted in Item 1.37.1 will be considered in evaluating the overall tender.

.4 MCW Consultants Ltd. reserves the right to review costing using accepted Contractor's Pricing Standards.

1.37 RESPONSIBILITIES OF THE CONTRACTOR

.1 The Electrical Subcontractor shall contact the Consultant within two weeks of award of Electrical Subcontract

.2 The Electrical Subcontractor shall arrange to meet with the Consultant at the Consultant's office for a (minimum) two hour pre-construction meeting, prior to, or within one week of job mobilization. An agenda for the meeting will be made available once Items 26 00 10.2.1.1.1, .2 and .3 above are received. The Electrical Subcontractor's Job Site Foreman must be in attendance.

.3 Supervise the work at all times through a responsible and competent supervisor.

.4 The Consultant shall not approve Progress Billings until such time as Items 26 00 10.2.1.1 and 26 00 10.2.1.2 above are:

.1 Complete

.2 Deemed impossible or unnecessary by the Consultant.

.5 The Consultant shall issue a letter of conformance regarding Items i) and ii). All blanks must be filled in, and the form must be signed by an authorized Supervisor of the Electrical Subcontractor, to be deemed complete.

.6 The Electrical Subcontractor shall submit Progress Billings by copying and typing on suitable form as approved by the Consultant. Approval for alternative formats must be made at least one week before the first progress billing submission. Submissions with unapproved format will not be approved.

.7 The Contractor shall respond to deficiencies in writing, where requested by the Consultant, as specified in Section 26 00 10.1.9.

1.38 SUBSTANTIAL PERFORMANCE

.1 The Consultant shall make a Representative available for one substantial performance inspection within one week of receipt of the following:

.1 Verification Certificate and complete report for fire alarm and life safety system by the fire alarm manufacturer indicating that the system is complete, tested and in conformance with the specification and local jurisdiction requirements. Refer to Fire Alarm System.

.2 A letter from the Electrical Subcontractor stating that the fire alarm and life safety system, are complete, tested and fully operational as per the plans and specifications, including all formal changes to the Contract. The letter shall further state that all deficiencies sited by the Consultant or local Electrical or Building Inspector have been completed and accepted.

.3 A letter from each system supplier indicating that the following systems are complete and tested as per the specifications and ready for operation:

.1 P.A. system

.2 Intercom system

.3 Local area network (LAN)

.4 Security system

.5 Emergency call

.6 Enterphone

.7 Voice/Data Communication

.8 Telephone system

.9 Low voltage lighting control system

.10 Energy management system

.11 Demand control systems

.4 Completed and approved Maintenance Manuals as per Item 26 00 10.1.7.

.5 Completed and approved Record Drawings as per Item 26 00 10.1.13.

.2 Before or during the substantial performance inspection, the Electrical Subcontractor shall prove the proper performance of all fire alarm, emergency call, and life safety systems, in the presence of and to the satisfaction of the Consultant, local inspection authorities and the city (or his representative).

Part 2 Products

2.1 NOT USED

.1 Not Used

Part 3 Execution

3.1 ROOFTOP EQUIPMENT

.1 Cabling on the roof shall be installed in EMT conduit with watertight fittings or Teck90 cable.

.1 Cabling installed in conduit shall be supported by c-ports at a spacing no more than 1m (39”) on-centre.

.2 Teck90 cable shall be supported by c-ports at a spacing no more than 1m (39”) on-centre.

.2 Conduits and cabling shall be supported independently from the roof structure.

.3 Conduit and cables shall penetrate the roof as close to the associated equipment as practical. Cable and conduit runs on the roof shall not exceed 3m (10’) from their associated roof penetration. Routing extended beyond this limit shall be reviewed with Consultant prior to installation.

.4 Conduit and cables installed on the roof shall follow building lines. “As-the-crow-flies” installations are not acceptable.

.5 Junction boxes, if required, shall be installed a minimum of 750mm above the finished roof level, measured to the underside of the enclosure.

.6 Disconnects, receptacles and starters shall be installed a minimum of 750mm above the finished roof level, measured to the underside of the enclosure.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 26 00 10 – Basic Electrical Materials and Methods

.2 Section 26 05 34 – Conduit

.3 Section 26 05 29 – Fastenings and Supports

.4 Section 26 27 16 – Cabinets, Splitters, Junction Boxes

.5 Section 26 05 35 – Outlet Boxes and Fittings

.6 Section 26 27 26 – Wiring Devices

1.2 COORDINATION

.1 The building shall remain open and in normal operation during the construction period.

.2 Where existing services, such as electrical power, fire alarm system, sound system, etc., are required to be disrupted and/or shut-down, coordinate the shut-downs with The city and carry out the work at a time and in a manner acceptable to them. Carefully schedule all disruption and/or shut-downs and ensure that the duration of same is kept to the absolute minimum. Submit for approval a written, concise schedule of each disruption at least 120 hours in advance of performing work and obtain The city's written consent prior to implementing.

.3 Should any temporary connections be required to maintain services during work in the existing building, supply and install all necessary material and equipment and provide all labour at no extra cost. Should any existing system be damaged, make full repairs without extra cost, and to the satisfaction of The city and Contract Administrator.

.4 Refer to general conditions for phasing and staging of work and adhere to that schedule. Comply with instructions regarding working hours necessary to maintain the building in operation.

.5 Coordinate complete installation of relocated utility services, if required, with utilities to ensure minimum interruption of service. Coordinate the transfer of the existing Hydro service point to the new service point with the Hydro utility in order to keep power interruptions to a minimum.

1.3 EXISTING DEVICES IN NEW CONSTRUCTION

.1 Where existing devices (receptacles, switches, etc.) presently mounted on a wall which will be covered with a new finish, provide an extension ring, coverplate, etc., as required to mount the device to the new wall.

.2 Where existing conduits pass vertically through a floor area, relocate those conduits to be installed concealed in a new wall or surface-mounted in a service area. Extend conduit, wiring, etc., as required.

.3 Existing junction boxes in walls and ceiling spaces required to maintain existing circuits shall remain accessible.

1.4 SCHEDULE OF WORK

.1 Carefully note and refer to the Architect's general schedule of work and include for all requirements to conform to it.

Part 2 Products

2.1 MATERIALS

.1 Provide all materials required for the complete interface and reconnection installation as herein described and as indicated on the drawings.

.2 New fire alarm devices, speakers, starters, panelboards, etc., required to be tied into existing systems shall match the existing devices.

.3 New wiring required to interconnect new devices to existing systems shall be provided to suit the manufacturer's requirements and instructions.

Part 3 Execution

3.1 INSTALLATION

.1 Install boxes, conduit and wiring through existing areas as required for the new installation.

.2 Add modules, switches, etc., in existing control panels, as required, to extend existing systems to new or renovated areas.

.3 Patch and repair walls and ceilings in existing areas that have been damaged to cut open due to the new electrical installation.

.4 Where new cables or conduits have been installed through existing fire rated walls, seal opening around cables and conduit to maintain fire rating.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 26 00 10 - Basic Electrical Material and Methods

.2 Section 26 05 34 – Conduit

.3 Section 27 05 28 - Communication Cabling Raceways

.4 Section 26 05 29 - Fastenings and Support

Part 2 Products

2.1 MATERIALS

.1 Conductors in Conduit (R-90):

Type:	RW-90
Conductors:	Solid copper #10 AWG and smaller. Stranded copper #8 AWG and larger. Sized as indicated (minimum #12 AWG)
Insulation:	Cross link polyethylene (XLPE), 90ºC. (194ºF)
Configuration:	Single conductor
Voltage Rating:	1000V
Certification:	CSA C22.22 No.38 or latest revision

.2 Armored Cable:

Type:	AC-90
Conductors:	Solid copper #10 AWG and smaller. Stranded copper #8 AWG and larger. Sized as indicated (minimum #12 AWG).
Insulation:	Cross link polyethylene (XLPE), 90ºC. (194ºF)
Configuration:	Multi-conductor, as required, complete with a separate bare CU ground wire.
Voltage Rating:	600V
Armor	Bare interlocked aluminium.
Certification:	CSA C22.22 No.38 or latest revision

.3 Armored Cable (Teck):

Type:	Teck 90.
Conductors:	Solid copper #10 AWG and smaller. Stranded copper #8 AWG and larger. Sized as indicated (minimum #12 AWG).
Insulation:	Cross link polyethylene (XLPE), 90ºC. (194ºF).
Configuration	Multi-conductor, as required, complete with a separate bare CU ground wire.

Color Code:	Black, red, blue and white in 4/c cable. Cables of more than 4/c to be number coded.
Voltage Rating:	1 kV or 5 kV as indicated.*
Inner Jacket:	Black polyvinyl chloride (PVC) Low flame spread (LFS). Low gas emission (LGE).
Armor:	Interlocked aluminium.
Outer Jacket:	Black polyvinyl chloride (PVC), -40ºC. (-40ºF) Low flame spread (LFS). Low gas emission (LGE).
Fire Rated:	FT4.
Certification:	CSA C22.22 No. 131 or latest revision.

.4 Armored Cable (ACWU):

Type:	ACWU
Conductors:	Stranded Aluminum #6 AWG or larger. Sized as indicated (minimum #6 AWG). Sized as indicated (minimum #12 AWG).
Insulation:	Cross link polyethylene (XLPE), 90ºC. (194ºF).
Configuration:	Multi-conductor, as required, complete with a separate bare AL bonding conductor
Colour Code	Black, Red, Blue and White in 4/c cable
Voltage Rating:	600V.
Aluminium Sheath:	Liquid and vapour tight solid corrugation.
Outer Jacket:	Black PVC, -40*C. Low flame spread (LFS). Low gas emission (LGE).
Fire Rating:	FT4. AG14 rating
Certification :	CSA C22.22 No. 51 or latest revision.

.5 Aluminium Sheathed Cables:

Type:	RA-90.
Conductors:	Solid copper #10 AWG and smaller. Stranded copper #8 AWG and larger. Sized as indicated (minimum #12 AWG).
Insulation:	Cross link polyethylene (XLPE), 90ºC. (194ºF)
Configuration:	Single conductor.
Voltage Rating:	1000V.
Aluminium Sheath:	Liquid and vapour tight solid corrugation.
Outer Jacket:	Polyvinyl chloride (PVC), -40ºC. (-40ºF) Low flame spread (LFS). Low gas emission (LGE).
Fire Rating:	FT4.
Certification :	CSA C22.22 No. 123 or latest revision.

Ground: Provide bare bond sized to Table 16 C.E.C.

.6 Electronic Cables

Conductors: 18 AWG- STC solid copper.
Insulation: Polyvinyl chloride (PVC).
Configuration: Twisted pairs (No. as indicated)
Shielding: Copper braid.
Voltage Rating: 300V.
Certification: CSA.

.7 Fire Alarm

Conductor: Solid copper #18 AWG.
Insulation: 105ºC (221ºF) flame retardant PVC.
Configuration Multi-conductor (minimum 4 conductors per cable).
Voltage Rating: 300V
Conductor Identification: Color coded.
Shielding: Aluminium mylar foil.
Outer Jacket: 105ºC (221ºF) red PVC jacket.
Certification: CSA Class #5851-01 File #LR41741.
UL subject 1424 File #E-83163. Or latest revision

.8 FAS Fire Alarm Armoured Cable

Conductor: Solid bare copper
Inner Jacket: Red PVC
Armour: Red tinted aluminum interlocked
Temperature -30°C bend to 105°C.
Configuration: 3 cond, 5 cond.
Shield: Aluminum Polyester Shield
Certification: CSA, FAS, FT4, SR

.9 Non-Metallic Cable:

1. Interior Use (Wood Construction Only)

Type: NMD-90.
Conductors: Solid copper #10AWG and smaller.
Stranded copper #8 AWG and larger.
Sized as indicated. (Minimum #12 AWG for public areas and #14 AWG for suites)
Insulation: Polyvinyl chloride (PVC), 60ºC. (140ºF)
Configuration: Multi-conductor, as required, complete with a separate bare CU ground wire.
Voltage Rating: 300V.
Outer Jacket: Polyvinyl chloride (PVC).
Certification: CSA C22.22 No. 48 or latest revision.

2. Direct Buried Use

Type : NMWU
Conductors: Solid copper #10 AWG and smaller.
Stranded copper #8 AWG and larger.

	Sized as indicated (minimum #12 AWG).
Insulation:	Polyvinyl chloride (PVC), 60ºC (140ºF).
Configuration:	Multi-conductor, as required, complete with a separate bare CU ground wire.
Voltage Rating:	300V
Outer Jacket:	Polyvinyl chloride (PVC).
Certification:	CSA C22.22 No. 48 or latest revision.

.10 Instrumentation Cable:

Type:	Instrumentation cable.
Conductors:	7 wire, concentric lay, Class B, tinned copper, #18 Or #14 AWG, required.
Voltage Rating:	300V or 600V, as required
Insulation:	Fire retardant – cross link polyethylene (XLPE), 90°C. (194°F).
Configuration:	Single or multi-pairs or triads, as indicated.
Shielding:	Aluminium/mylar shield with drain wire for each pair or Triad. Overall aluminium/mylar shield with drain wire.
Drain Wires:	7 wire, concentric lay, Class B, tinned copper. Individual shields to be one size smaller than conductor size. Overall shields to be the same as conductor size.
Color Codes:	300V pairs – black, white and number code. 300V triads – black, white and number code. 600V pairs – black, red and number code. 600V triads – black, red, yellow and number code.
Armor:	Interlocked aluminium.
Outer Jacket:	Grey polyvinyl chloride (PVC). Low flame spread (LFS). Low gas emission (LGE).
Fire Rating:	FT6
Certification:	CSA C21.1 or latest revision. CSA C22.2 No.174 or latest revision.

.11 Power Cables:

Type	High voltage power cable 5 kV-46 kV.
Conductors	Stranded copper size as indicated.
Conductor Shielding	Semi-conducting cross link polyethylene.
Insulation	Unfilled cross-linked polyethylene.
Insulation Shielding	Cross linked polyethylene.
Configuration	Single or multi-conductor.
Metallic	100% cover copper tapes or concentric wires with Inter-locked aluminium armour.
Outer Jacket	Polyvinyl chloride (PVC) –40°C. (-40°F).

	Low flame spread (LFS).
	Low gas emission (LGE).
Certification	A.E.I.C. CS-5
	I.C.E.A. S-66-524.
	C.S.A. C68.2.
	R.E.A. U-1

.12 Low Voltage Control Cables:

Type:	LVT.
Conductors:	Solid copper #18 AWG.
Insulation:	Thermoplastic, color coded.
Configuration:	Single. Two conductor – parallel, Three or more conductors twisted.
Voltage Rating:	30V.
Outer Jacket:	Thermoplastic.
Certification:	CSA C22.22 No. 35. Or latest revision
Fire Rating	FT6

.13 Mineral Insulated Cables:

Type:	M.I.
Conductors:	Solid copper size as indicated.
Insulation:	Magnesium oxide.
Configuration:	Single, two, three or four conductor as indicated.
Voltage Rating:	600V.
Outer Jacket:	Copper.

.14 Variable Speed Drive Cabling (DriveRx):

Type	Variable Frequency Drive Cable
Conductors	Copper
Insulation	Cross link polyethylene (XLPE), 90ºC. (194ºF).
Configuration	Single, two, three or four conductors as indicated
Voltage Rating	1000V
Outer Jacket	PVC
Fire Rating	FT4

.15 Pressure type connectors, fixture type splicing connectors, cable clamps and lugs, as required.

Part 3 Execution

3.1 INSTALLATION IN RACEWAYS

.1 Install wiring as follows:

1. In conduit systems in accordance with Section 26 05 34.

2. In underground ducts in accordance with Section 26 05 44.
3. In wireways and auxiliary gutters in accordance with Section 26 05 33.
4. Ensure conduits are dry and free of debris before pulling cables.
5. Color coding and identification as per this Section.
6. Wires in outlet, junction and switch boxes, not having a connection within the box shall not be spliced, but shall continue unbroken through the box.

3.2 INSTALLATION SINGLE CONDUCTOR CABLES

.1 Single conductor cables shall be installed one cable diameter apart on suspended cable tray or channel supports and shall be clamped with aluminium cable clamps. Cables shall be terminated using non-magnetic connectors. Cable armour shall be grounded via an aluminium plate at the supply end and isolated via an insulating plate, at the load end of the cable. A #3/0 AWG bare (unless otherwise noted) copper ground wire shall be installed with each set of feeder cables. Cable bending radius shall be at least twelve times the overall cable diameter and bend shall not damage or distort the outer sheath.

.2 Install cables in trenches as per Section 26 05 45.

.3 Do not install PVC jacketed cables in circulating air plenums.

.4 Provide pressure tight connectors when aluminum cable is utilized.

3.3 INSTALLATION OF FLEXIBLE ARMOURED CABLE

.1 Type AC-90 armoured cable (BX) shall be used for connections from conduit systems to recessed luminaires in accessible ceilings. Cable shall be of sufficient length to allow the lighting fixture to be relocated to any location within a 6’ (1.83 mm) radios. Cable shall be clamped before entering the lighting fixture and shall be clipped before entering the conduit system junction box. (Minimum requirements)

.2 Type AC-90 armoured cable may be used for connections from conduit systems to wiring devices in steel stud partitions and for interconnection of wiring devices within steel stud partitions, cable shall be clipped before entering junction or outlet boxes.

.3 Type AC-90 ISO-BX as supplied by Alcatel shall be used for isolated ground receptacles.

3.4 INSTALLATION OF MINERAL INSULATED CABLE

.1 M.I. cable shall be installed in complete unbroken lengths parallel with building lines and terminated as per manufacturer’s instructions. Care shall be taken at all times to prevent the entry of moisture into ends of the table.

.2 M.I. cable shall be surface-mounted to building surfaces with copper clips or straps as per manufactures installation guidelines.

.3 Provide manufacture testing reports and include in maintenance manuals.

3.5 INSTALLATION OF NON-METALLIC CABLE

.1 Interior type non-metallic cable may only be installed in wood structure buildings of combustible construction. It shall not be installed in steel studs.

.2 Directed buried non-metallic cable shall be installed below grade as per Section 26 05 45.

.3 Soft wiring of telephone and TV in steel studs shall be run through grommeted holes.

3.6 INSTALLATION IN EQUIPMENT

.1 Group and lace-in neatly, wire and cable installed in switchboards, panelboards, cabinets, wireways and other such enclosures.

3.7 TERMINATIONS

.1 Terminate wires and cables with appropriate connectors in an approved manner.

3.8 MOTOR CONNECTIONS

.1 Flexible connections to motors shall not exceed 78” (2 m) unless authorized in writing by Consultant. Utilize liquid-tight flexible metal conduit or Teck cable with approved Teck connectors.

3.9 IDENTIFICATION

.1 Wire in conduit #2 AWG and smaller shall have solid coloured insulation, color coded as listed below.

.2 Wire in conduit #1 AWG and larger and single conductor cables for normal power feeders shall be identified at each outlet box and termination with a 6” (150 mm) band of coloured vinyl tape of the appropriate color. Emergency power feeders shall be provided with an additional 3” (75 mm) band of red vinyl tape installed adjacent to the 6” (150 mm) band of the coloured phase identification tape, as listed below. Neutral and ground conductors shall be identified. Paint or other means of coloring the insulation shall not be used.

.3 Color code wire in conduit and single conductor cables as follows:

Phase A	red
Phase B	black
Phase C	blue
Neutral	White
Ground	Green

Unless shown otherwise on the drawings.

.4 Maintain phase sequence and color coding throughout project.

.5 Use color coded wires in communication cables, matched throughout system.

.6 Identify control conductors in motor equipment, contactors, fire alarm panels, etc. with Mylar / cloth wire markers.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 26 00 10 - Basic Electrical Material and Methods.

.2 Section 26 05 19 - Wire and Cable

.3 Section 26 24 14 - Main Distribution Switchboard

1.2 REFERENCES

.1 Ground equipment to: CSA C22.2 No. 41,or latest revision

.2 Copper grounding conductors to: CSA G7.1 or latest revision.

Part 2 Products

2.1 EQUIPMENT

.1 Grounding conductors system, circuit and equipment, grounding to be bare stranded copper, sized in accordance with the Canadian Electrical Code.

.2 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

- .1 grounding and bonding bushings
- .2 protective type clamps
- .3 bolted type conductor connectors
- .4 thermit welded type conductor connectors
- .5 bonding jumpers, straps
- .6 pressure wire connectors

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous, system and circuit, grounding systems including electrodes, conductors, connectors and accessories to conform to requirements of local authority having jurisdiction over installation.

.2 Install connectors to manufacturer’s instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Make buried connections using copper welding by thermit process.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs. Soldered joints not permitted.

.6 The main public metallic water service to a building shall be utilized as the main ground electrode. Where such a service does not exist, then an artificial grounding electrode shall be provided to suit the requirements of the local inspection authorities.

.7 Install bonding wire for flexible conduit, connected to both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.8 Install separate ground conductor, to exterior pole mounted luminaires.

.9 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.10 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end and run separate ground conductor.

.11 Provide separate ground conductors in PVC conduit, plastic or fibreglass raceways.

3.2 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral points of 600V and 208V systems.

3.3 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to: service equipment, transformers, frame of motors, motor control centres, starters, control panels, building steel work, generators, elevators distribution panels, outdoor lighting.

3.4 COMMUNICATION SYSTEMS

.1 Install grounding connections for telephone, sound, fire alarm, intercommunication systems as follows:

.1 Provide minimum #6 AWG ground from voice/data rooms to main building ground as indicated.

.2 Sound, fire alarm, intercommunication system, as indicated.

3.5 PADMOUNTED TRANSFORMER

.1 Provide grounding connections to the padmounted transformer in conformance with requirements of the supply authority.

3.6 TESTS

.1 Perform tests in accordance with Section 26 00 10.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of the local inspection authority. A report shall be submitted to the Consultant from the testing agency.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator, if provided, during tests.

.5 A ground electrode with an unsatisfactory resistance test result shall be altered as necessary until the required resistance reading is achieved.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 26 00 10 – Basic Electrical Materials and Methods

.2 Section 26 05 19 – Wire and Cable

.3 Section 26 05 34 – Conduit

.4 Section 26 05 36 – Cable Tray

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U-shape galvanized steel uni-strut, size 1.6” x 1.6” (40 x 40mm), 0.1” (2.5mm) thick, surface-mounted, suspended or set in poured concrete walls and ceilings as required.

2.2 MANUFACTURERS

.1 Acceptable manufacturers: Burndy, Unistrut, Pilgrim, Caddy.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors or nylon shields.

.2 Secure equipment to poured concrete with cast-in or expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface-mounted equipment with twist clip fasteners to inverted T-bar ceilings. Ensure that T-bars are adequately supported to carry weight of equipment specified before installation. Provide additional support where required.

.5 Support equipment, conduit or cables on support channels using clips, spring-loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

- .1 One-hole steel straps to secure surface conduits and cables 1 ¼” (32mm) and smaller.
- .2 Two-hole steel straps for conduits and cables larger than 1 ¼” (32mm).
- .3 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.

.1 Support individual cable or conduit runs with ¼" (6mm) dia. Threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 3/8" (10mm) diameter threaded rod hangers where direct fastenings to building construction is impractical.

.8 For surface-mounting of two or more conduits use channels at 60" (1.52m) o.c.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.11 Do not use wire lashing, perforated pipe straps or tie-wraps to support or secure raceways or cables.

.12 Do not use supports or equipment installed for other trades for conduit or cable support except when otherwise approved by the Consultant.

.13 Cabling and conduit shall be independently supported using the appropriate method.

.14 Install fastenings and supports as required for each type of equipment cables and conduits, in accordance with manufacturer's installation recommendations.

.15 Where conduit and cable runs are installed on support systems, they shall be run so as to be as inconspicuous as possible. Coordinate support system path with equipment, of other trades, to ensure proper installation of electrical equipment. Run support system path perpendicular or parallel to building lines.

.16 Cut off all excess threaded rod on support systems.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 26 00 10 – Basic Electrical Materials and Methods.

.2 Section 26 05 29 – Fastenings and Supports

1.2 LOCATION OF CONDUIT

.1 Drawings do not show all conduits. Those shown are diagrammatic form only.

.2 Electrical Subcontractor shall produce layout sketches of conduit runs through mechanical and electrical service areas in order to pre-avoid any conflict with other construction elements and to determine the most efficient route to run conduit.

Part 2 Products

2.1 CONDUITS

.1 Rigid galvanized steel threaded conduit: size as indicated.

.2 Electrical metallic tubing (EMT), size as indicated.

.3 Rigid PVC conduit: size as indicated.

.4 Flexible metal conduit and liquid-tight flexible metal conduit: size as indicated.

.5 FRE duct: size 2” (53mm) and above as indicated.

.6 Electrical non-metallic tubing (ENT) only as indicated.

2.2 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 1 ¼” (35mm) and smaller. Two hole steel straps for conduits larger than 1 ¼” (35mm).

.2 Beam clamps to secure conduits to exposed steel work.

.3 U-channel type supports as specified in Section 26 05 29.2.1.1 for two or more conduits at 60” (1.52m) intervals (surface-mounted or suspended).

.4 3/8” (10mm) diameter threaded rods to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings manufactured for use with conduit specified.

.2 Manufacturer elbows where 90º bends are required for 2 ½” (63mm) and larger conduits.

.3 Steel set screw connectors and couplings. Insulated throat liners on connectors.

.4 Raintight connector fittings complete with O-rings, for use on weatherproof or sprinklerproof enclosures.

.5 Raintight connectors shall be used for all top entries to panels, disconnects, contactors and motor control centres.

.6 Raintight couplings and connectors shall be used for surface conduit installations exposed to moisture, attic spaces, crawlspaces and exterior.

2.4 EXPANSION FITTINGS FOR RIGID AND PVC CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly, suitable for 4" (100mm) or 8" (200mm) linear expansion, as required.

.2 Watertight expansion fittings suitable for linear expansion, and ¾" (21mm) deflection in all directions, as required.

.3 Weatherproof expansion fittings for linear expansion at entry to panel as required.

.4 O-ring type expansion fittings for PVC conduit.

.5 Flexible watertight conduit between junction boxes with integral bonding jumper suitable for linear and lateral movement greater than ¾" (21mm).

Part 3 Execution

3.1 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms.

.3 Use electrical metallic tubing (EMT) except where noted otherwise.

.4 Provide a separate insulated bonding conductor in all conduits.

.5 Wiring home runs to panels and main branch wiring runs in ceiling spaces shall be run in conduit. Wiring drops from conduit systems into boxes for wiring devices in steel stud partitions may be wired with AC-90. AC-90 drops to light fixtures shall not run horizontally more than 6' (1.83m) from conduit system junction boxes in ceiling space. AC-90 drops from conduit system in the ceiling space to feed outlets in steel stud partitions shall not run more than 6' (1.83m) horizontally from the ceiling outlet box to the point where the AC-90 drops vertically into the partition.

.6 Use rigid PVC conduit for underground installations.

.7 The use of electrical non-metallic tubing (ENT) shall be limited to in-slab installations only and must be approved by Consultant prior to installation.

.8 Use flexible metal conduit for connection to fluorescent fixtures recessed in T-bar ceilings, suspended fixtures, and equipment subject to movement or vibration. Provide a separate insulated grounding conductor within flexible conduit.

.9 Use liquid-tight flexible metal conduit for connection to motors and transformers. Provide a separate insulating ground conductor within conduit.

.10 All wiring under computer floors shall be in liquid-tight flexible metal conduit, or teck cable, where indicated.

.11 Use threaded rigid conduit and fittings in hazardous areas, concrete encased duct banks or where conduit is exposed to mechanical injury. Install conduit sealing fittings in hazardous areas and fill with compound. Field threads on rigid conduit shall be sufficient length to draw conduits up tight. Mechanically bend rigid steel conduit over ¾" (21mm) diameter.

.12 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.13 Install polypropylene fish cord in empty conduits.

.14 Install two 1" (27mm) spare conduits up to ceiling space and two 1" (27mm) spare conduits down to ceiling space below from each recessed panelboard, cabinet, annunciator, etc. Terminate these conduits in 6" x 6" x 4" (150 x 150 x 100mm) junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in a flush concrete-type box with extension ring.

.15 Where conduits become blocked, remove and replace blocked section.

.16 Dry conduits out before installing wire.

.17 The length of any conduit run shall not exceed 100' (33m) and no conduit run shall have more than two 90º bends (or equivalent) before a pullbox is installed. Pullboxes shall be installed in accessible ceiling spaces. Conduits shall be supported within 12" (300mm) of entering any junction box, pullbox, cabinet, or panelboard.

.18 Install equipment and apparatus including but not limited to junction boxes, adjustment or eventual replacement with adequate clearances and accessibility for same. Accessibility is deemed to be within 600mm (24") of accessible drywall ceiling opening and no more than 1m (39") above ACT.

.19 Conduit shall be sized as per Canadian Electrical Code or as shown on drawings. Note that the sizes of branch circuit conductors scheduled and/or specified on the drawings are minimum sizes and shall be increased as required to suit length of run and voltage drop in accordance with Canadian Electrical Code. Where conductor sizes are increased to suit voltage drop requirements, increase the conduit size to suit at no extra cost.

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not locate conduits within 78" (2m) of infrared or gas-fired heaters.

.3 Group conduits wherever possible on suspended or surface channels.

.4 Do not pass conduits through structural members, except as indicated.

.5 Do not locate conduits less than 6” (150mm) to steam or hot water lines.

3.3 CONCEALED CONDUITS

.1 Do not install conduit home runs horizontally in masonry walls.

.2 Do not install conduits in terrazzo or concrete toppings, unless otherwise indicated.

3.4 CONDUITS IN POURED CONCRETE

.1 Locate to suit reinforcing steel. Install in centre one third of slab. Maximum permissible conduit size in slabs is 1” (25mm). Parallel runs of conduit shall have a minimum separation of 6” (150mm) face-to-face. Conduits may cross provided the maximum aggregate height based on outside diameters does not exceed 2 ½” (64mm). Do not install conduits in drop panels, beams or columns. Submit a marked up drawing of proposed conduit runs complete with conduit sizes to Structural Engineer and Electrical Consultant for approval prior to installation.

.2 Provide 5” x 7” (125 x 175mm) color photographs of conduits installed in slab, where conduits are grouped, or cannot follow perpendicular or parallel to building lines. As-constructed drawings shall show all conduit runs embedded in concrete slabs, or run below slab, with measurements from fixed building lines (an/or columns).

.3 Protect conduits from damage where they stub out of concrete.

.4 Install sleeves where conduits pass through slab or wall.

.5 Where conduits pass through waterproof membrane, provide oversized sleeve before membrane is installed. Use cold mastic between sleeve and conduit.

.6 Do not install conduits larger than 1” (27mm) in concrete slabs without prior approval or Architect.

3.5 CONDUITS IN POURED SLABS ON GRADE

.1 Run conduits larger than 1” (25mm) below slab and encased in 3” (75mm) concrete envelope. Provide ground wire in all conduits below grade.

3.6 CONDUITS UNDERGROUND

.1 Use PVC conduits or FRE duct underground. Provide a separate ground wire in non-metallic conduits.

.2 All fittings shall be waterproof.

.3 Slope conduits to provide drainage.

3.7 CONDUIT IDENTIFICATION

.1 Colour code coverplates of junction boxes in conduit systems as per the colour code list below.

.2 Colour code by spray painting the coverplate on each junction box in the conduit run.

.3 In addition to colour coding coverplates on junction boxes with power wiring, the circuits being run in the box shall be identified on the inside of coverplate with permanent felt marker.

120/208V Normal Power	yellow
120/208V Emergency Power	fluorescent red
347/600V Normal	orange
347/600V Emergency Power	fluorescent orange
Fire Alarm	red
Telephone	purple
Security	royal blue
CCTV	black
Ground	green
PA/Sound	brown
Nurse Call	sky blue
Controls	white
Satellite or Cable TV	fluorescent green

.4 Provide pre-manufactured peel and stick labels for each system on every conduit penetrating a wall or floor and at each junction box location.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 26 00 10 – Basic Electrical Materials and Methods

.2 Section 26 05 34 – Conduits

1.2 SYSTEM DESCRIPTION

.1 Provide boxes to suit each specified application. Locate as indicated.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES – GENERAL

.1 Size boxes in accordance with CSA C22.1, Section 12.

.2 Multi-gang boxes where wiring devices are grouped.

.3 Blank coverplates for boxes without wiring devices.

.4 347V outlet boxes for 347V switching devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel device boxes for flush installation, minimum size 4” (100mm) square with extension and plaster rings, as required.

.2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit.

.3 4” (100mm) square or octagonal outlet boxes for lighting fixture outlets.

.4 4” (100mm) square outlet boxes with extension and plaster rings flush-mounting devices in finished plaster and tile walls.

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi-gang boxes for devices flush-mounted in exposed block or brick walls.

2.4 CONCRETE BOXES

.1 Electro-galvanized sheet steel concrete-type boxes for flush-mount in concrete with matching extension and plaster rings as required.

2.5 FLOOR BOXES

.1 Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with aluminum faceplate. Device mounting plate to accommodate duplex receptacle and data outlet complete with leashed cover or ¾" (19mm) threaded plugs for service.

.2 Ensure floor box is sized to suit appropriate floor thickness

2.6 CONDUIT BOXES

.1 Cast FS or FD feraloy boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles where exposed to moisture.

2.7 FITTINGS – GENERAL

.1 Bushings and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of foreign materials.

.3 Conduit outlet bodies for conduit up to 1 ¼" (35mm) and pullboxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

2.8 SECTIONAL BOXES

.1 Do not utilize sectional boxes.

Part 3 Execution

3.1 INSTALLATION OF BOXES

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of construction material.

.3 For flush installations, mount outlets flush with finished wall using plaster rings to permit wall finish to come within ¼" (6mm) of opening.

.4 Cut in and recess outlet boxes in existing walls including cutting into block walls for flush finish.

.5 Surface mounted outlet boxes accessible to public spaces shall be completely sealed free of knock outs. Use of surface mounted outlet boxes must be approved by consultant prior to installation.

.6 Provide correct size of openings in boxes for conduit and cable connections. Reducing washers not allowed.

.7 Maintain continuity of vapour barrier where boxes are installed in exterior walls.

.8 Boxes shall be mounted plumb and square with building lines.

.9 Co-ordinate boxes in masonry with brick or block configuration. Boxes shall be sawcut in of appropriate brick or block.

.10 Co-ordinate locations with millwork.

.11 Verify exact location of floor boxes with Architect. Adjust floor boxes level with finished floor.

.12 Verify exact location of service fittings with furniture drawings and/or Architect. Service fittings shall be installed parallel and perpendicular to building lines.

.13 Contractor shall scan structure before making openings and advise Contractor and Contract Administer any obstructions found prior to cutting or coring. Scan shall be completed prior to ordering material to be installed in or through concrete to ensure proper fit.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 Perform a review of the Owner's power system and verify all equipment data as required to support a complete study and analysis. Generalized assumptions are not permitted to be used for calculations.

.2 Provide a short circuit and protective device coordination studies.

.3 Provide an arc-flash hazard analysis per the requirements in the latest revisions of CSA Z462 and IEEE Std 1584.

.1 The arc-flash hazard analysis shall include all electrical distribution equipment fed from the point of interconnection (POI) with the utility.

.4 Update on single line diagrams with any modified information and supply new drawings where required.

1.2 REFERENCES

.1 CSA Standards

.1 CSA C22.1 - Canadian Electrical Code, Part I

.2 CSA Z462 - Workplace Electrical Safety

.2 IEEE Standards

.1 IEEE Std 242 – IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems

.2 IEEE Std 551 - Recommended Practice for Calculating AC Short-Circuit Currents in Industrial and Commercial Power Systems

.3 IEEE Std 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations

1.3 SUBMITTALS

.1 The following shall be submitted as part of the shop drawing review for electrical distribution equipment:

.1 Supply one (1) complete paper copy of the report, including appendices.

.2 Supply one (1) pdf copy of the report, compiled into a single pdf, identical to the paper copy.

.3 All source information used to create the power system model.

.4 Power system model in native format, including any custom library components.

.5 Provide one (1) set of approved equipment labels.

1.4 QUALIFICATIONS

.1 The studies shall be prepared under the responsible charge and approval of a qualified Professional Engineer licensed to practice or Engineering Licensee who holds a valid and subsisting specified scope of practice licensed in the Province in which the final installation resides and skilled in performing and interpreting power system studies. The engineer shall have a minimum of 5 years' experience and specialize in power system studies.

.2 Approved and Sealed by a Professional Engineer or Engineering Licensee, licensed in the Province in which the final installation resides.

.3 The studies shall be performed using the latest version of one of the following software packages, no substitutions will be accepted.

.1 etap Electrical Power System Analysis & Operations Software

.2 SKM Power Tools

.3 EasyPower Power System Software

Part 2 Products

2.1 EQUIPMENT LABELS

.1 Arc flash and shock warning labels should be the applicable production and installation requirements of ANSI/NEMA Z535.4.

.2 Labels shall be printed using thermal transfer technology on vinyl.

.3 Labels for outdoor equipment shall be UV resistant to avoid fading.

.4 All Labels will be based on recommended overcurrent devices settings and will be provided after any system changes, upgrades, or modifications have been incorporated into the system.

.5 Labels shall contain the detailed arc flash and shock warning information as described in Appendix Q.4 of CSA Z462 and as shown in Figure Q.3.

Part 3 Studies

3.1 DATA COLLECTION

.1 Verify all data collected by the owner and owner's representative on site, as required.

.2 Data collection will begin at the utility POI and continue throughout the Owner's electrical distribution system as required to complete the studies.

.3 Obtain from the utility the minimum and maximum three-phase short circuit MVA and X/R ratio and line-to-ground short circuit MVA and X/R ratio at the POI.

.1 When the utility information is not available, reasonable assumptions may be made and applied to the scenarios developed for the analysis to ensure a worst case range is determined.

.4 Provide qualified personnel to open all existing equipment doors, locks, etc. to collect and verify nameplate data, as required.

.5 If data is not available for protective devices settings, reasonable assumptions may be made and shall be chosen to be conservative (increase incident energy levels). All assumptions shall be clearly indicated within the protection coordination study.

.6 Transformer design impedances shall be used when test impedance values are not available.

3.2 SHORT CIRCUIT STUDY

.1 The purpose of the short circuit study is to evaluate the interrupting duty of overcurrent protective devices at all parts of the electrical system. The short circuit study shall consider all system configurations that may result in maximum fault conditions.

.2 The short circuit study shall include all pertinent data, assumptions, clarifications and rationale used in development to the power system model and calculation results.

.3 Motors 50 hp and larger shall be included in the study.

.4 Provide in writing any equipment or protective devices that are improperly rated for the calculated fault current.

.5 For solidly-grounded systems, provide a bolted line-to-ground fault current study for applicable buses as determined by the engineer performing the study.

3.3 PROTECTION COORDINATION STUDY

.1 The purpose of the protection coordination study is to verify setting minimize damage caused by an electrical fault and allow for selective coordination of overcurrent protective devices. The protection study shall consider all operation scenarios used in the short circuit study.

.2 The protection coordination study shall include all pertinent data, assumptions, clarifications and rationale used in development to the power system model and time-current curve (TCC) plots.

.3 The TCC shall be computer generated on a log-log scale. Hand drawn curves shall not be accepted.

.4 The following shall be included on TCC plots, where applicable:

.1 Utility protective device settings
.2 Owner's protective devices settings
.3 Transformer damage curves and inrush current
.4 Conductor damage curves
.5 Motor starting curves for motors over 50 hp

.5 Recommended settings and/or confirmation of existing settings shall be provided in tabular format.

3.4 ARC FLASH HAZARD ANALYSIS

.1 The purpose of the arc flash hazard analysis is to determine the incident energy and arc flash boundary at all electrical distribution equipment where there is likelihood of an arc flash incident occurring.

.2 The arc flash hazard analysis shall include the following electrical equipment:

.1 Medium Voltage switchgear
.2 Switchboards
.3 Panelboards
.4 Motor control centres
.5 Load centers
.6 Splitters
.7 Other electrical equipment where the engineer doing the study identifies a likelihood of an arc flash incident occurring.

.3 The incident energy shall be calculated by approved software as indicated in Part 1.

.4 The incident energy levels shall be calculated for all operational scenarios.

.5 The arc flash hazard analysis shall include all pertinent data, assumptions, clarifications and rationale used in development to the power system model and results.

.6 The study shall summarize the worst case incident energy levels.

.7 Arc flash warning labels shall be for the worst case incident energy levels only.

3.5 FINAL REPORT

.1 The final report shall be compile all the studies and include the following Sections:

.1 Executive Summary
.2 Introduction
.3 Basis of Study
.4 Short Circuit Study
.5 Coordination Study

.6 Arc Flash Hazard Analysis

.7 Recommendations

.8 Appendices

Part 4 Execution

4.1 PROTECTIVE DEVICE SETTINGS

.1 Apply protective device settings as recommended by the protective device coordination study.

.2 Contractor shall provide a report in tabular format identifying each circuit breaker adjusted as a result of this study, including the following information for each circuit breaker:

.1 The name of the circuit breaker matching the project single line diagram designations.

.2 The frame and trip unit rating.

.3 The settings applied to the trip unit for all adjustable settings available.

.3 The final report of these settings and adjustments shall be signed by the contractor performing the work and included in the project closeout documents prior to issuance of substantial completion.

4.2 LABELS

.1 One (1) warning label shall be provided for each electrical distribution equipment item studied in the arc flash hazard analysis, based on the worst case incident energies and the protective devices settings recommended by the protective coordination study.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Mechanical Specifications

.2 Section 26 00 10 – Basic Electrical Materials & Methods

.3 Section 26 05 34 – Conduit

.4 Section 26 05 19 – Wire and Cable

.5 Section 26 05 35 – Outlet Boxes and Fittings

.6 Section 26 29 13 – Motor Starters

.7 Section 26 28 16 – Motor and Circuit Disconnects

.8 Section 26 24 19 – Motor Control Centres

1.2 SYSTEM DESCRIPTION

.1 Provide complete electrical power and control connections for mechanical equipment, except as noted herein, or as noted on the drawings.

Part 2 Products

2.1 MATERIALS

.1 Include motor starters, disconnects, conduit, wire, fittings, interlocks, outlet boxes, junction boxes, and all associated equipment required to provide power wiring for mechanical equipment, unless otherwise indicated.

.2 Include pushbutton stations, motor protective switches, interlocks, conduit, wire, devices, and fittings required to provide control wiring for mechanical equipment, except for temperature/humidity control systems.

.3 Unless otherwise noted, motors and control devices shall be supplied by Mechanical. Motor horsepower ratings shall be as shown in the Mechanical specifications. Motor voltage and phase ratings shall be as shown on the Electrical drawings.

2.2 EXTERIOR EQUIPMENT

.1 All equipment, mounted on the exterior of the building, shall be weatherproof.

.2 Exterior disconnect switches shall be weatherproof and amounted a minimum of 750mm above roof independent of equipment.

Part 3 Execution

3.1 POWER WIRING

.1 Install power feeders, starters, disconnects, and associated equipment and make connections to all mechanical equipment.

.2 Install branch circuit wiring for mechanical system control panels, time clocks, and control transformers.

.3 Install main power feeders to starter/control panels furnished by Mechanical. Install branch wiring from starter/control panels to controlled equipment such as motors, electric coils, etc.

.4 Conduit, wire, devices and fittings required to wire and connect low voltage temperage control systems, shall be supplied and installed by the trade supplying the temperature control system. Control wiring shall be installed in conduit.

.5 Wire and connect electrical interlocks for starters supplied by Mechanical.

.6 Wire and connect hi-limit cut-outs for remotely mounted electric heating coils provided by Mechanical.

.7 Wire and connect thermistor control devices, built-in to large motors, to motor starters, as per wiring diagrams provided by Mechanical.

.8 Provide boiler power disconnect switch at Boiler Room exit doors for each boiler. Coverplate for switches shall be red with lamacoid nameplate (Boiler #1, Boiler #2, etc.).

3.2 CONTROLS

.1 Install all electrical controls, except low voltage temperature controls, unless otherwise noted herein. Controls which have both electrical and mechanical connections shall be installed by the trade supplying the control.

.2 Wire and connect line voltage remote thermostats and P/E switches for furnaces, condensing units, force flows, gas-fired unit heaters, electric heaters and rooftop units.

.3 Wire and connect float switches, pressure switches, alternators, alarms, etc. for sump pumps, sewage pumps, domestic hot water re-circulating pumps, booster pumps, jockey pumps and compressors.

.4 Conduit, wire, devices and fittings required to wire and connect low voltage controls, which are an integral part of a packaged unit, shall be supplied by the trade supplying the packaged unit, unless otherwise indicated. Control wiring shall be installed in conduit.

.5 Wire and connect electrical interlocks for starters supplied by Mechanical.

.6 Wire and connect hi-limit cut-outs for remotely mounted electric heating coils provided by Mechanical.

.7 Wire and connect thermistor control devices, built-in to large motors, to motor starters, as per wiring diagrams provided by Mechanical.

3.3 FIRE PROTECTION (SPRINKLER & STANDPIPE)

.1 Wire and connect the flow, pressure and tamper switches, installed on the sprinkler and standpipe systems, to separate zones in the fire alarm control panel. Refer to Fire Protection and Mechanical Drawings for the exact location of these switches.

.2 Provide an E.O.L.R. for each zone and locate adjacent to monitored device.

.3 Wire and connect fire pump controller supervisory signals to fire alarm control panel.

.4 Wire and connect fire pump transfer switch control wiring for loss of power and generator start signals.

.5 Wire and connect the system pre-action sprinkler and solenoid valve along with any air compression required for the pre-action sprinkler system. Pre-action system shall be connected to a dedicated zone in the FACP.

3.4 CO-ORDINATION

.1 Refer to mechanical drawings for the exact location of motor control devices, and other mechanical equipment requiring an electrical connection.

.2 Obtain full information from Mechanical, regarding wiring controls, overload heaters, equipment ratings and over-current protection. Notify the Mechanical, at once, if any information provided is incorrect or unsatisfactory.

.3 Refer to Mechanical specifications for any further electrical requirements.

.4 Review both electrical and mechanical drawings and specifications and co-ordinate all controls with Mechanical Subtrades through General Contractor. Report all discrepancies to both mechanical and electrical consultants before close of tender. No additional money will be justified for assumptions made on any duplication of information.

.5 Submit to General Contractor, as part of the tender submission, a list of controls and wiring to be provided in the Electrical Contract.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 26 00 10 – Basic Electrical Materials and Methods

.2 Section 26 05 34 – Conduit

.3 Section 26 05 19 – Wire and Cables

.4 Section 26 05 35 – Outlet Boxes and Fittings

.5 Section 26 27 26 – Wiring Devices

.6 Section 26 28 16 – Motor and Circuit Disconnects

1.2 SYSTEM DESCRIPTION

.1 Make all required electrical connections to devices, equipment, appliances, etc., furnished by other trades or Owner, as indicated or implied on the drawings or in the specifications.

.2 Provide and install miscellaneous electrical components where required.

1.3 COORDINATION

.1 Verify electrical supply characteristics of all equipment prior to rough-in. Report any discrepancies immediately. Revise wire sizing, device type, connection type, breaker size, etc., as required, to accommodate the electrical supply characteristics of the equipment supplied by other trades.

Part 2 Products

2.1 GENERAL

.1 Provide all required electrical devices, components, conduits, fittings, wiring, disconnects, and miscellaneous equipment to make all connections to equipment.

.2 Be familiar with the apparatus being supplied and carefully coordinate and cooperate with the supplier/installer to ensure a proper and complete installation.

2.2 RECEPTACLES

.1 Where equipment has line cord and plug, ensure cap is compatible with receptacle. Provide cord sets to equipment where required.

2.3 HEAT TRACING CABLES

.1 Heat/tracing cable for pipes to be self-limiting type rated at 10 watts/foot.

.2 Voltage and length as indicated.

.3 Provide additional cabling at all pipe supports, valves etc. as per manufacturers recommendations.

.4 Provide cold lead connection kit and locate as indicated.

.5 Electrical Contractor shall supply and install cables to manufacturer's recommendations and ANSI/IEEE 515.1 standards.

.6 Provide 30mA trip GFI breakers for all heat tracing circuits.

.7 Acceptable manufacturer: Raychem.

2.4 ELECTRIC HAND-DRYERS

.1 American Dryer

.1 Electric hand-dryers shall have the following features:

.1 One piece, heavy-duty 18 gauge stainless steel, lightweight and virtually indestructible cover.

.2 Powerful series commutated through-flow discharge vacuum motor/blower with automatic resetting thermal protector. 5/8 Hp, 20,000 RPM.

.3 100% solid state automatic sensor design eliminates relay contact failures. Microprocessor controlled infrared sensor turns dryer on when hands are under the air outlet. Dryer turns off when hands are removed.

.4 Two (2) tamper resistant screws secure cover to steel base. Blower air intake shielded for additional safety.

.2 Recessed kits shall be provided for recessed units to reduce depth of dryer to less than four inches (4"). Recess kit shall be ADA-RK.

.3 Equipment shall be equal to American Dryer Extreme Air CPC.

Model		Electric Rating			
Stainless Steel	**White Enamel**	**Volts**	**Amps**	**Watts**	**Hertz**
CPC9-SS-R	**CPC9-M-R**	**120/208-240 (Universal)**	**12.5/6.5**	**1500-800**	**50/60**

.4 Provide stainless Steel model as base unit. White shall only be supplied as requested by Architect.

.5 Equipment shall be complete with 5 year limited warranty.

Part 3 Execution

3.1 BARRIER FREE DOOR OPERATIONS AND CONTROLS

.1 Wire and connect operator motors, and safety controls for the motorized entrance/exit doors as per the equipment supplier requirements.

.2 Wire and connect associated controls including, but not limited to entry pushbuttons, kick buttons, power supplies, motion sensors, panic hardware switches, powered hinges, electric strikes, key switches etc.

.3 Refer to architectural door hardware schedules and/or electrical door hardware schedule for further requirements.

3.2 ILLUMINATED SIGNS

.1 Wire and connect all illuminated signs. Provide a disconnect at each sign.

.2 Utilize water-tight wiring methods.

3.3 EQUIPMENT SUPPLIED BY OTHER TRADES OR OWNER

.1 Wire and connect all equipment requiring an electrical connection. Install disconnect switches where required.

.2 Provide a direct connection or receptacle and cord set to suit hook-up requirements of each piece of equipment. Confirm connection method with Owner or General Contractor.

3.4 ELECTRIC HAND-DRYERS

.1 Install, wire and connect equipment as shown on drawings. Refer to circuiting for voltage requirements.

.2 Mount recessed mounting kit for all recessed units.

.3 Provide adequate support for secure mounting including blocking where required.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 14 20 00 – Elevators

.2 Section 26 00 10 – Basic Electrical Materials and Methods

.3 Section 26 05 34 – Conduit

.4 Section 26 05 19 – Wire and Cables

.5 Section 26 27 16 – Cabinets, Splitters, Junction and Pullboxes

.6 Section 26 28 16 – Motor and Circuit Disconnects

.7 Section 26 28 13 – Fuses

.8 Section 28 31 31 – Fire Alarm System

1.2 SYSTEM DESCRIPTION

.1 Provide all electrical equipment, conduit, and wiring necessary to interconnect the elevator and dumbwaiter components, equipment, machine rooms, pits and shafts to the power distribution, fire alarm and telephone system.

.2 System shall conform to Firefighters Emergency Operation CSA B44-10.

1.3 COORDINATION

.1 Obtain elevator shop drawings and install power supply, lighting, communication conduit and fire alarm interconnections as required.

.2 Firefighters emergency operation shall apply to all automatic elevators except where hoistway not required to be fire resistant construction (rise does not exceed 2000mm or hoistway does not penetrate a floor.)

Part 2 Products

2.1 MATERIALS

.1 Provide separate lockable fused disconnect switches and fuses in the elevator machine room for each elevator motor, each controller and the lights in each elevator cab. Locate disconnects adjacent to the lock side of the door. Fuses and switch rating shall be sized to suit the elevator equipment supplier's requirements.

.2 Provide a telephone junction box in each machine room with a ¾" (19mm) empty conduit run to the closest telephone terminal location.

.3 Provide a fire alarm junction box in each machine room and tie in to the main fire alarm panel with 6#12 conductors in a ¾" (19mm) conduit.

.4 Provide smoke detector in each elevator machine room.

.5 Provide a fixed temperature heat detector at the top of each elevator shaft.

.6 Provide smoke detectors on each floor in elevator lobbies.

.7 Provide lighting, complete with switch and receptacle, in each machine room, elevator pit and top of shaft.

.8 Provide a connection from each controller to the standby generator transfer switch with 4#12 conductors in a ½" (13 mm) conduit.

.9 Provide a 1 ½" (38mm) empty conduit from each elevator pit (single or common shaft) to the control station location for the respective elevators.

.10 Provide smoke detector in each level elevator lobby to conform to CSA B-44 clause 2.27.3 for emergency recall and fire alarm interconnection where a building has a fire alarm system.

Part 3 Execution

3.1 POWER DISCONNECTS

.1 Install disconnects for the elevator motor, controller and cab lighting where indicated on elevator shop drawings. Wire and connect from power distribution to disconnects and from disconnects to the controller.

.2 Power disconnect shall be 4 pole or be complete with relay for disconnect of battery power supply.

3.2 TELEPHONE

.1 Install telephone junction box. Provide a ¾" (19mm) conduit from the telephone room to junction box and from the junction box to controller.

3.3 LIGHTING AND RECEPTACLES

.1 Provide machine lighting switches, receptacles and associated wiring. Locate as per elevator shop drawings.

.2 Provide pit and top of shaft lighting, switches, receptacles and associated wiring. Locate as per elevator shop drawings. Install wire guards on lights.

.3 All receptacles associated with Elevator shall be G.F.I. Type.

3.4 FIRE ALARM

.1 Install smoke detector and associated wiring in each machine room to home elevators for emergency recall operation.

.2 Install heat detectors and associated zone wiring at the top of each elevator shaft. Mount end of line resistors (where applicable) in elevator machine room or in

mechanical room adjacent to shaft. Provide lamacoid as indicated in Section 26 00 10. Heat detector to activate emergency recall operation.

.3 Install wiring from the fire alarm control panel to elevator controllers to sequentially home elevators to main floor upon activation of the fire alarm system. Provide conductors and smoke detectors in elevator lobbies to activate emergency recall operation and alternate floor homing in all buildings where hoistway penetrates a floor level.

3.5 FEEDER

.1 Feeder shall be 2 hour rated cable or cable mounted in a 2 hour fire rating.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 Permanent electric service shall be provided from the utility company primary electrical system, to the electrical service equipment.

1.2 WORK RELATED

.1 Connection cabinets, pullboxes, special enclosures, etc. shall be provided as indicated on the drawings and as required for a complete installation.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

.1 All electrical service components shall, as a minimum, be in compliance with the Canadian Electrical Code and all utility company requirements.

Part 2 Products

2.1 SERVICE ENTRANCE COMPONENTS

.1 The service entrance configuration and the electrical characteristics shall be as indicated on the drawings.

.2 Underground service entrance conduits shall be located a minimum of 36” below grade.

.3 Connection cabinets (where indicated and required) shall be pad mounted galvanized steel, painted grey and constructed to the utility company requirements.

.4 Current transformer cabinets (where indicated and required), shall be galvanized steel painted grey, with a continuous piano hinge, and a sealing clasp integral with the main switchboard installation.

.5 Metering system configuration(s) shall be as indicated on the drawings.

.6 Pad mounted transformers shall be mounted on a poured-in-place, reinforced concrete pad, or a pre-cast pad, as required by the utility company.

.7 All service transformers shall be provided by the utility company.

Part 3 Execution

3.1 COORDINATION

.1 Contractor shall initiate, co-ordinate, and schedule all utility company associated work.

.2 Co-ordinate scheduling of service installation with the project construction schedule.

3.2 INSTALLATION

.1 The electrical service and all components shall, as a minimum, be in compliance with all utility company requirements.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 26 00 10 – Basic Electrical Materials and Methods

.2 Section 26 05 34 – Conduit

.3 Section 26 05 19 – Wire and Cable

.4 Section 26 05 44 – Underground Duct Bank

.5 Section 26 05 45 – Underground Conduit and Cables

1.2 COORDINATION WITH HYDRO SUPPLY AUTHORITY

.1 Make all arrangements and co-ordinate with Hydro supply authority to ensure availability of service when required.

.2 Submit all required drawings to supply authority for their approval.

.3 Refer to Section 26 00 10 for cash allowance requirements associated with electrical service by the supply authority.

1.3 COORDINATION WITH TELEPHONE AUTHORITY

.1 Make all arrangements and co-ordinate with telephone utility to ensure availability of service when required.

Part 2 Products

2.1 EQUIPMENT

.1 Underground duct bank in accordance with Section 26 05 44.

.2 Conduit and fittings to Section 26 05 34.

Part 3 Execution

3.1 PAD MOUNTED TRANSFORMER

.1 Pad mounted transformer shall be supplied and installed by supply authority, unless otherwise indicated.

.2 Co-ordinate with the Contractor the provision of a concrete pad, if required, for the pad mounted transformer. Pad shall be placed in accordance with Hydro utility requirements.

.3 Co-ordinate with Contractor the provision of vehicle protection bollards, if required, for the pad mounted transformer. Bollards shall be concrete filled, 8” (200mm)

diameter steel posts and placed around the pad mounted transformer in accordance with the Hydro utility requirements.

.4 Install transformer ground grid in accordance with supply authority regulations.

3.2 PRIMARY CABLES

.1 Primary cables to the utility supplied pad mounted transformer or the customer supplied service entrance switchgear shall be provided by the Hydro utility.

.2 Provide a concrete encased duct bank as installed from the service entrance switchgear cable pit to the property line for the installation of primary cables or provide a trench, as required, from the pad mounted transformer to the property line for the installation of primary cables.

3.3 SECONDARY CABLES

.1 Install secondary cables from pad mounted transformer or dip pole to main distribution, via a trench as indicated. Allow adequate conductor length for termination. Backfill trench and restore surface to original condition.

.2 Arrange for inspection of cables in trench by Consultant BEFORE backfill, or provide and pay for Certificate of Inspection by Utility.

.3 Provide for all new underground conductor installations, identification label (min 3" x 5 " permanently secured lamacoid near each service or overcurrent supplying equipment) identifying the following:

.1 Code year to which the installation was designed.

.2 U/G diagram and detail Appendix B.

.3 Table and detail Appendix D.

.4 Size and type of conductor.

.5 Ampacity.

.6 Maximum overcurrent.

3.4 TELEPHONE ENTRANCE CONDUIT

.1 Install telephone service entrance rigid steel conduit from the main telephone terminal board to be stubbed out 36" (914mm) past the building and 30" (762mm) below grade where indicated.

3.5 TELEPHONE SERVICE CABLE TRENCHES

.1 Provide trenching for the telephone service entrance cable from the stubbed out conduit to the telephone utility service pedestal, joint use trench, or property line to suit the telephone utility requirements.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 26 00 10 – Basic Electrical Materials and Methods

.2 Section 26 05 25 – Grounding

1.2 SUBMITTALS

.1 Submit product data in accordance with Section 26 00 10.

Part 2 Products

2.1 MATERIALS

.1 Dry-type transformers: to CSA C9-M1981 and CAN/CSAC-802.2-00 and USA NEMA TP-1, or latest revision.

.2 Use distribution transformers of one manufacturer throughout project.

2.2 TRANSFORMERS – VENTILATED

.1 Type: ANN.

.2 3-phase, 600V Delta, primary 120/280V “Y”, secondary 60 Hz.

.3 kVA capacities as indicated.

.4 150°C (302°F) temperature rise insulation system.

.5 Basic Impulse Level (BIL): standard.

.6 Hi-pot: standard.

.7 Average sound level: standard.

.8 Impedance at 170°C (338°F): standard.

.9 Enclosure: air ventilated sprinklerproof NEMA/CSA (type 3R enclosures and labelled accordingly), removable metal front panel. Rear panel shall be unremovable.

.10 Mounting: floor, wall or ceiling suspended as indicated.

.11 Finish: in accordance with Section 26 00 10.

.12 Primary taps: two 2 ½% FCAN and two 2 ½% FCBN.

.13 Windings: copper.

2.3 TRANSFORMERS – NON-VENTILATED

.1 Epoxy potted.

.2 3-phase, 600V Delta, primary 120/208V “Y”, secondary 60 Hz.

.3 115° temperature rise insulation system.

.4 Basic Impulse Level (BIL): standard.

.5 Hi-pot: standard.

.6 Average sound level: 45 dB.

.7 Impedance at 170°C [338°F]: standard.

.8 Enclosure: sealed.

.9 Mounting: floor or wall as indicated.

.10 Finish: in accordance with Section 26 00 10.

.11 Windings: copper.

2.4 MINI POWER CENTERS

.1 Totally enclosed distribution center shall have an integral, epoxy potted 600: 120/208V transformer, main primary breaker and branch breaker panelboard. Components as listed below.

.2 Entire assembly shall be factory assembled.

.3 3-phase, 600V Delta, primary 120/208V “Y”, secondary 60 Hz.

.4 115° temperature rise insulation system.

.5 Basic Impulse Level (BIL): standard.

.6 Hi-pot: standard.

.7 Average sound level: 45 dB.

.8 Impedance at 170°C (338°F): standard.

.9 Enclosure: sealed.

.10 Mounting: pad or rack, as indicated.

.11 Finish: in accordance with Section 26 00 10.

.12 Breakers: to Section 26 28 17.

.13 Breakers with thermal magnetic tripping in panelboards, except as indicated otherwise.

.14 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.15 Windings: copper.

2.5 K-RATED TRANSFORMERS

.1 Type: K-13 rated.

.2 3 phase, 600 Delta primary, 120/208 “Y” secondary 60 Hz.

.3 kVA capacities as indicated.

.4 115°C temperature rise insulation system.

.5 Basic impulse level (BIL): Standard.

.6 Average sound level: 300 kVA – 52 dB.

.7 Impedance: 3% to 5%, with a minimum reactance of 2%.

.8 Construction:

.1 Cores shall be constructed with low hystersis and eddy current loses. Core flux density shall be well below the saturation point. Transformers shall be common core construction.

.2 Secondary neutral shall be sized for 200% of the secondary phase current.

.3 Transformer enclosures shall be ventilated and sprinkler proof. Removable metal front panel. Rear panel shall be unremovable.

.4 Transformers shall be supplied with a quality full width electrostatic shield resulting in a maximum effective coupling capacitance between primary and secondary of 33 PF. Attenuation of line noise and transients shall equal or exceed the following limits:

.1 Common Mode: 0 to 1.5 KHZ – 120 dB; 1.5 HKZ to 10 KHXZ – 90 dB; 10 KHZ to 100 KHZ – 65 dB, 100 KHZ to 1 MHZ – 40 dB.

.2 Transverse Mode: 1.5 KHZ to 10 KHZ – 52 dB; 10 KHZ to 100 KHZ – 30 dB; 100 KHZ to 1 MHZ – 30 dB.

.9 Mounting: Floor mounted.

.10 Finish: In accordance with Section 26 00 10.

.11 Primary Taps: 6 – 2.5% full capacity primary taps.

.12 Windings: copper.

2.6 MANUFACTURERS

.1 Acceptable manufacturers: Westinghouse, Federal Pioneer, Square D, Hammond, Delta, REX and BEMAG.

Part 3 Execution

3.1 MOUNTING

.1 Mount dry-type transformers on floor with a 4” (100 mm) high concrete housekeeping pad, unless otherwise indicated.

.2 Suspend dry-type transformers from structure on a U-channel and threaded rod support system complete with insulation springs, as indicated. Maximum size shall be 75kVA. Submit installation detail to structural consultant for review.

.3 Allow 6” (150 mm) of clearance from walls and 4” (100 mm) from adjacent equipment for ventilation.

.4 Install transformers in level upright position.

.5 Remove shipping supports only after transformer is installed and just before putting into service.

.6 Loosen isolation pad bolts until no compression is visible.

.7 Mount transformers with vibration isolators.

.8 Install epoxy potted transformers on wall, unless otherwise indicated.

3.2 CONNECTIONS

.1 Make final connections with liquid tight flexible conduit to mitigate vibration.

.2 Energize transformers immediately after installation is completed, where practicable.

.3 Provide grounding as per Section 26 05 25.

3.3 EQUIPMENT IDENTIFICATION

.1 Size 7 label in accordance with Section 26 00 10.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 26 00 10 – Basic Electrical Materials and Methods

.2 Section 26 05 34 – Conduit

.3 Section 26 05 19 – Wire and Cable

.4 Section 26 28 17 – Circuit Breakers

.5 Section 26 10 15 – Utilities Underground Service Entrance

1.2 SUBMITTALS

.1 Submit shop drawings and produce data in accordance with Section 26 00 10.

.2 Indicate:

- .1 Floor anchoring method and foundation template.
- .2 Dimensioned cable entry and exit locations.
- .3 Dimensioned position and size of bus.
- .4 Overall length, height and depth.
- .5 Dimensioned layout of internal and front panel mounted components.
- .6 Shipping sections and weights.

1.3 MAINTENANCE DATA

.1 Provide data for incorporation into Maintenance Manual specified in Section 26 00 10.

1.4 MAINTENANCE MATERIALS

.1 One set spare parts as recommended by manufacturer.

1.5 SOURCE QUALITY CONTROL

.1 Refer to Section 26 00 10.

1.6 PLANT ASSEMBLY

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements, manufacture's nameplate must show fault current that bus and breakers have been built to withstand.

Part 2 Products

2.1 MATERIALS

.1 Service entrance board: to CSA C22.2 No. 31 and Section 26 24 16.

.2 Molded case circuit breakers: to CSA C22.2 No. 5 and Section 26 28 17.

2.2 MOUNTING

.1 Distribution CDP suitable for pad mounting.

2.3 PAD MOUNT DISTRIBUTION

.1 Ampere rating: as indicated on the drawings.

.2 Enclosure:

.1 Freestanding, totally enclosed sheet steel, enclosure with steel frame.

.2 Sheet steel barriers to separate adjoining sections.

.3 Distribution section.

.4 High conductivity aluminum bus.

.5 Identify phases with color coding.

.3 All equipment and ancillary devices shall be weatherproof and suitable for ± 40ºC (109ºF) ambient temperatures.

2.4 GROUNDING

.1 Copper ground bus extending full width of cubicles and located at bottom.

.2 Lugs at each end size for grounding cable.

.3 Bond non-current carrying metal parts to ground bus.

2.5 DISTRIBUTION SECTION

.1 The distribution section to consist of a CDP-type panelboard with molded case circuit breakers. Each breaker shall be manually operated, fixed-type with trip ratings as shown on the drawings. Minimum interrupting rating to be 42,000 amps symmetrical.

.2 The distribution section to be provided with a minimum of 1-400 amp, 3 pole frame space.

2.6 FINISH

.1 Finish weatherproof pad mount CDP exterior in accordance with Section 26 00 10- Electrical General Provisions.

2.7 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 00 10- Electrical General Provisions.

.2 Nameplates:

.1 Black plate, white letters, Size 7, to indicate voltage, amp rating and designation.

.2 Breakers: labelled to indicate panel or equipment fed.

Part 3 Execution

3.1 INSTALLATION

.1 Locate pad mount CDP as indicated.

.2 Connect main secondary service entrance cables to line terminals of switchboard.

.3 Connect load terminals of distribution breakers to outgoing feeders as indicated.

.4 Check factory-made connections for mechanical security and electrical continuity.

.5 Run one #1/0, bare copper, grounding conductor from ground bus to the ground electrode.

.6 Manufacturer to provide test equipment and field test overload, magnetic tripping. Include Test Report in Maintenance Manuals.

.7 Switchboard manufacturer to provide a co-ordination and short circuit study and submit to Consultant with switchboard shop drawings.

.8 Co-ordinate installation with The city.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 26 00 10 – Basic Electrical Materials and Methods

.2 Section 26 28 17 – Circuit Breakers

.3 Section 26 05 34 – Conduit

.4 Section 26 05 19 – Wire and Cable

1.2 DESCRIPTION OF EQUIPMENT

.1 Main distribution board incorporates service entrance cable connection section, main breaker complete with built-in ground fault, utility metering transformer compartment, sub-feeder distribution section and customer metering section, factory assembled in one enclosure.

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 26 00 10.

.2 Indicate:

.1 Floor anchoring method and foundation template.

.2 Dimensioned cable entry and exit locations.

.3 Dimensioned position and size of bus.

.4 Overall length, height and depth.

.5 Dimensioned layout of internal and front panel mounted components.

.6 Shipping sections and weights.

1.4 MAINTENANCE DATA

.1 Provide data for incorporation into Maintenance Manual specified in Section 26 00 10.

1.5 MAINTENANCE MATERIALS

.1 One set of spare parts as recommended by manufacturer.

.2 Fuses:

.1 3 fuses for each type above 600A.

.2 6 fuses for each type up to and including 600A.

1.6 SOURCE QUALITY CONTROL

.1 Refer to Section 26 00 10.

Part 2 Products

2.1 MATERIALS

.1 Service entrance board: to CSA C22.2 No. 31.

.2 Molded case circuit breakers: to CSA C22.2 No. 5.

.3 Fuse holder assemblies: to CSA C22.2 No. 39.

.4 HRC Fuses: to CSA C22.2 No. 106.

.5 Meters: to CSA C17.

.6 Meter mounting devices: to CSA C22.2 No. 115.

.7 Digital instruments: to ANSI C39.1 and UL508.

.8 Instrument transformers: to CSA C13.

2.2 POWER SUPPLY

.1 Power supply: 3 phase, 4 wire, grounded neutral, 60 Hz, short circuit current rated at 42 KA RMS symmetrical, voltage as indicated on the drawings.

2.3 SERVICE ENTRANCE SWITCHBOARD

.1 Ampere rating: as indicated on the drawings.

.2 Enclosure:

.1 Free-standing, totally enclosed sheet steel, ‘sprinklerproof’ enclosure with steel frame.

.2 Sheet steel barriers to separate adjoining sections.

.3 Provision for installation of supply authority metering transformers.

.4 Customer metering instruments, transformers and selector switches.

.5 Distribution section.

.6 Hinged access panels with captive knurled thumbscrews. Utility metering section to have provision for utility seals.

.7 High conductivity aluminum bus.

.8 Bus from load terminals of main

.9 Identify phases with colour coding.

2.4 MAIN BREAKER SECTION

.1 The main circuit breaker shall be a manually operable, fixed mounted molded case circuit breaker. Breaker shall be constructed in accordance with the following standards: UL489, NEMA AB1-1986, CSA 22.5 No. 5.

.2 Breaker shall be complete with a microprocessor based, RMS sensing trip system or the breaker shall be equipped with an independent of any external power source and shall be LI, LIG, LS or LSG (as indicated) to provide time/current curve shaping

adjustments. Local visual indication for overload, short circuit and ground fault trip occurrences.

.1 ( ) LI - Adjustable Long Time Ampere Rating and Delay
- .1 Adjustable Instantaneous Pickup.
- .2 Fixed Selective Override

.2 ( ) LIG - Adjustable Long Time Ampere Rating and Delay
- .1 Adjustable Instantaneous Pickup.
- .2 Adjustable Ground Fault Pickup and Delay
- .3 (delay includes I2t IN and I2t OUT)
- .4 Fixed Selective Override

.3 ( ) LS - Adjustable Long Time Ampere Rating and Delay
- .1 Adjustable Short Time Pickup and Delay
- .2 (delay includes I2t IN and I2t OUT)
- .3 Adjustable Defeatable Instantaneous Pickup
- .4 Fixed Selective Override

.4 ( ) LSG - Adjustable Long Time Ampere Rating and Delay
- .1 Adjustable Short Time Pickup and Delay
- .2 (delay includes I2t IN and I2t OUT)
- .3 Adjustable Defeatable Instantaneous Pickup
- .4 (delay includes I2t IN and I2t OUT)
- .5 Fixed Selective Override

.3 Breaker shall be equipped with test port for use with manufacturer's test set enabling testing of all trip functions (without actual tripping of breaker) and without disassembly of breaker.

2.5 GROUNDING

.1 Copper ground bus extending full width of cubicles and located at bottom.

.2 Lugs at each end sized for grounding cable.

.3 Bond non-current carrying metal parts to ground bus.

2.6 HYDRO UTILITY METERING SECTION

.1 Separate compartment for exclusive use of utility company metering transformers.

.2 Provide mounting and wiring for the following:
- .1 potential transformers
- .2 current transformers

.3 Hydro utility metering transformers shall be supplied by the Hydro utility and factory installed by the switchboard manufacturer.

2.7 CUSTOMER METERING SECTION

.1 The Circuit Monitor vendor shall be ISO 9000 registered to demonstrate quality compliance.

.2 The current and voltage signals shall be digitally sampled at a rate high enough to provide valid data for waveform analysis and true-RMS metering accurate beyond the 30th harmonic (fundamental of 60Hz).

.3 The Circuit Monitors shall be listed to UL508, industrially rated for an operating temperature range of –25ºC to 70ºC and have an overcurrent withstand rating of 500 amps for one second.

.4 The Circuit Monitor shall be accurate to .15% of reading plus .05% of full scale for voltage and current metering, and .3% for all power and energy functions.

.1 These accuracies shall be maintained for both light and full loads and for power factors from .5 – 1.

.2 No annual recalibration by users shall be required to maintain these accuracies.

.3 Voltage and current for all phases shall be sampled simultaneously to assure high accuracy in conditions of low power factor or large waveform distortions (harmonics).

.4 The Circuit Monitor shall be capable of being applied without modification at nominal frequencies at 50, 60 or 400 hertz.

.5 The Circuit Monitor shall operate properly over a wide range of control power including 100-264 VAC or 100-300 VDC.

.6 Each Circuit Monitor shall be equipped with integral communications to permit information collected by the circuit monitor to be sent to central locations for display, analysis, and logging.

.1 Each Circuit Monitor shall have a spade lug connector for connection to an RS-485 serial communication link. The link shall use a common industry protocol that is factory proven.

.2 The Circuit Monitor shall be equipped with a front panel communications port as standard equipment. The port shall be completely accessible during normal operation and shall not require exposure of the operator to life-threatening voltage when in use. The operator shall be able to quickly connect a small Personal Computer (PC) to this port without use of tools or splices. This front panel port shall have all of the communication functionality of the standard hard wired rear port. When a connection is made to the front port, the Circuit Monitor shall disregard communication from the rear port until the front port is disconnected.

.7 The Circuit Monitors shall accept inputs from industry standard instrument transformers (120 VAC secondary PTs and 5A secondary CTs). Connection to 480Y/277 circuits shall be possible without use of PTs. In the interest of safety, provision shall be made that if PTs are not used, it shall not be

necessary to bring voltages greater than 120 VAC (line to neutral) to the Circuit Monitor itself.

.1 PT primaries through 1.2 MV shall be supported.

.2 T primaries through 32 kA shall be supported.

.8 All set-up parameters required by the Circuit Monitors shall be stored in non-volatile memory and retained in the event of a control power interruption. Any battery or other device used to provide non-volatile memory shall be user serviceable from the front of the Circuit Monitor and servicing shall not require removing the Circuit Monitor from the gear in which it is mounted.

.9 The Circuit Monitor shall maintain in non-volatile memory maximum and minimum values for each of the instantaneous values reported as well as the time and date that the minimum or maximum was set.

.10 Any Circuit Monitor may be applied in three phase, three or four wire systems. A fourth CT input shall be available to measure neutral or ground current. If the fourth CT is not used, then a residual current shall be calculated by vectorial addition of the phase currents.

.11 In 4-wire connections, the Circuit Monitor shall utilize the circuit neutral common reference and not earth ground to provide metering accuracy.

.12 The Circuit Monitor shall flush mount to an enclosure and be provided with an attractive finish bezel ring.

.1 The Circuit Monitors shall be equipped with an integral, continuous duty, long-life display to provide local access to continuous duty, long-life display to provide local access to the following metered quantities as well as the minimum and maximum value since last reset of each quantity:

.1 current, per phase RMS and neutral (if applicable)

.2 voltage, phase-to-phase & phase-to-neutral

.3 real power, per phase and 3-phase total

.4 reactive power, per phase and 3-phase total

.5 apparent power, per phase and 3-phase total

.6 power factor, 3-phase total and per phase

.7 frequency

.8 demand current, per phase and 3-phase average

.9 demand real power, 3-phase

.10 demand apparent power, 3-phase

.11 accumulated energy, (MWH and MVARH)

.12 K-factor, current, per phase

.2 Reset of the following electrical parameters shall also be allowed from the front of the Circuit Monitor:

.1 peak demand current

.2 peak demand power (kW) and peak demand apparent power (kVA)

.3 energy (MWH) and reactive energy (MVARH)

.3 Set-up for system requirements shall be allowed from the front of the Circuit Monitor. Set-up provisions shall include:

.1 CT rating (xxxxx:5)

.2 PT rating (xxxxxxx:120)

.3 Demand interval (5 – 60 min.)

.4 Watt-hours per pulse

.4 All reset and set-up functions shall have a means for protection against unauthorized/accidental changes.

.5 Displaying each of the Circuit Monitor quantities shall be accomplished through the use of vertical scroll buttons which select the next quantity in the list appearing on the face of the device.

.6 For ease in operator viewing, the display shall remain on continuously, with no detrimental effect on the life of the Circuit Monitor.

.13 It shall be possible to field upgrade the firmware in the Circuit Monitor to enhance functionality. These firmware upgrades shall be done through either the front or rear communication connection. No Circuit Monitor disassembly or changing of integrated circuit chips shall be required.

.14 The following metered values as well as their minimum and maximum instantaneous readings since last reset shall be communicated by the Circuit Monitor:

.1 frequency

.2 temperature

.3 current, per phase RMS and neutral (if applicable)

.4 current, 3-phase average RMS

.5 current, apparent RMS

.6 voltage, phase-to-phase & phase-to-neutral

.7 power factor, per phase

.8 power factor, 3-phase total

.9 real power, per phase and 3-phase total

.10 reactive power, per phase and 3-phase total

.11 apparent power, per phase and 3-phase total

.12 demand current, per phase and 3-phase average

.13 demand real power, 3-phase average

.14 demand apparent power, 3-phase average

.15 accumulated energy, (MWH, MVAH< and MVARH)

.16 Total Harmonic Distortion (THD), voltage and current, per phase

.17 K-factor, per phase

.15 All power demand calculations shall be done by any one of the following calculation methods, selectable by the user:

.1 Thermal demand using a sliding window updated every 15 seconds. The window length shall be set by the user from 5 to 60 minutes in 5 minute increments.

.2 Block interval, with optional sub-intervals. The window length shall be set by the user from 5 to 60 minutes in 5 minute intervals. The user shall be able to set the sub-interval length from 5 to 60 minutes in 5-minute intervals.

.3 External pulse synchronization, utilizing a synch pulse provided externally. An optional status input shall be used to sense the pulse.

.4 Sliding block interval with continuous sliding 15-second sub-intervals.

.1 The following demand readings shall be reported by the Circuit Monitor:

.1 average demand current, per phase

.2 peak demand current, per phase

.3 average demand for real power, reactive power, and apparent power

.4 predicted demand for real power, reactive power, and apparent power

.5 peak demand for real power, reactive power and apparent power

.2 The default demand calculation method shall be a 15-minute sliding window thermal demand.

.16 Each Circuit Monitor shall be capable of receiving a broadcast message over the communications network that can be used to synchronize demand calculations by several Circuit Monitors. This message need not be addressed specifically to any one Circuit Monitor.

.17 The following energy readings shall be reported by the Circuit Monitor:

.1 Accumulated energy

.2 Accumulated reactive energy

.3 Accumulated apparent energy

.1 For real and reactive energy reported values, separate totals for energy flow in each direction shall be kept, as well as an arithmetic sum.

.2 Each Circuit Monitor shall be capable of operating a solid state KYZ output relay to provide output pulses for a user

definable increment of reported energy. Minimum relay life shall be in excess of one billion operations.

2.8 DISTRIBUTION SECTION

.1 The distribution section to consist of a CDP type panelboard with molded case circuit breakers. Each breaker shall be manually operated, fixed type with trip ratings as shown on the drawings. Minimum interrupting rating to be 42,000 amps symmetrical.

.2 The distribution section to be provided with a minimum of 8-200 amp, 3 pole frame spaces.

2.9 FINISHES

.1 Apply finishes in accordance with Section 26 00 10:

.1 service entrance switchboard finish shall be exterior grey

.2 supply 2-spray cans of touch-up enamel

.3 treated to inhibit rusting.

2.10 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 00 10.

.2 Nameplates:

.1 black plate, white letters, size 7, to indicate voltage, amp rating and designation

.2 Complete switchboard: labelled as above main disconnect: labelled “main breaker”.

.3 Sub-breakers: labelled to indicate panel or equipment fed.

2.11 SHOP FABRICATION

.1 Assemble and wire complete service entrance board.

.2 Energize switchboard.

.3 Check meters and phase selector switches.

.4 Prepare switchboard for shipment to site.

2.12 MANUFACTURERS

.1 Acceptable manufacturers: Cutler Hammer, Federal Pioneer, Square D, Siemens.

2.13 FUTURE ENERGY MANAGEMENT

.1 Provide terminal board and wiring from separate customer CT’s and PT’s to facilitate the future installation of thermal demand, watt-hour energy management equipment, recorders, etc.

Part 3 Execution

3.1 INSTALLATION

.1 Locate service entrance switchboard as indicated.

.2 Connect main secondary service entrance cables to line terminals of switchboard.

.3 Connect load terminals of distribution breakers to outgoing feeders, as indicated.

.4 Check factory-made connections for mechanical security and electrical continuity.

.5 Run one #3/0, bare copper, grounding conductor in 1” (25mm) conduit from ground bus to the main building ground.

.6 Check relay settings against shop drawings to ensure proper working and protection of components.

.7 Manufacturer to provide test equipment and field test overload, magnetic and ground fault tripping. Include test report in Maintenance Manuals.

.8 Arrange for main distribution switchboard shall be mounted on 4” (100mm) housekeeping pad.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 26 00 10 – Basic Electrical Materials and Methods

.2 Section 26 05 34 – Conduit

.3 Section 26 28 17 – Circuit Breakers

1.2 SUBMITTALS

.1 Submit shop drawings in accordance with Section 26 00 10.

.2 Drawings shall include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.3 PLANT ASSEMBLY

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements, manufacturer's nameplate shall show fault current that panel, including breakers, has been built to withstand.

Part 2 Products

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No. 29-M1989, or latest edition.

.2 CDP panels: to CSA C22.2 No. 29-M1989, or latest edition, and shall be manufactured to allow installation of two 200A frame breakers adjacent to each other – horizontally.

.3 Panelboards shall be product of one manufacturer throughout project.

.4 250V branch circuit panelboards: bus and breakers rated for 10 kA symmetrical interrupting capacity minimum or as indicated.

.5 600V branch circuit panelboards: bus and breakers rated for 18kA symmetrical interrupting capacity, unless otherwise indicated.

.6 250V CDP panelboards: bus and breakers rated for 25 kA symmetrical interrupting capacity, unless otherwise indicated. CDP panels shall be complete with doors.

.7 600V CDP panelboards: bus and breakers rated for 22kA symmetrical interrupting capacity, unless otherwise indicated. CDP panels shall be complete with doors.

.8 Sequence phase bussing such that circuit breakers shall be numbered vertically in consecutive order. Each breaker shall be identified by permanent number identification as to circuit number.

.9 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.10 Two keys for each panelboard and key panelboards alike.

.11 Aluminum bus with full size neutral.

.12 Flush or surface-mounted tubs as shown.

.13 Finish trim and door baked grey enamel.

.14 CDP-type panelboards (breakers or fusible) shall be provided with a minimum of 6 – 200A, 3-pole, frame spaces.

.15 All panelboards and CDP's shall have "sprinklerproof" enclosures.

2.2 CUSTOM BUILT PANELBOARD ASSEMBLY

.1 Double section panels as indicated.

.2 Feed through lugs as indicated.

.3 Isolated ground bus as indicated.

.4 Weatherproof enclosure as indicated.

.5 Built-in contactors as indicated.

2.3 BREAKERS

.1 Breakers to Section 26 28 17.

.2 Breakers with thermal magnetic tripping in panelboards, except as indicated otherwise.

.3 Main breaker: mounted on top or bottom of panel to suit cable entry.

.4 Lock-on devices for 5% of 15A branch breakers installed as indicated. Turn over unused lock-on devices to The city.

.5 Lock-on devices for fire alarm, emergency, door supervisory, intercom, stairway, exit light, and nightlight circuits.

.6 Branch circuit breakers shall be 15A single-pole, unless otherwise indicated on drawings.

.7 225A panelboards shall be able to accept and serve breakers up to 150A/2P or 150A/3P.

.8 400A panelboards shall be able to accept and serve breakers up to 250A/2P or 250A/3P.

2.4 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 00 10.

.2 Size 4 nameplate for each panelboard and CDP to indicate panel designation and voltage.

.3 Size 3 nameplate for each breaker in CDP panelboards engraved to indicate load being supplied.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

2.5 LOAD CENTRES

.1 Load centres shall be used to provide branch circuit distribution requirements for suites in residential occupancies only.

.2 Mains shall be rated at 120/240V, single-phase, 150A mains.

.3 Number of circuits and number and size of branch circuit breakers shall be as indicated.

.4 Flush or surface-mounted tubs as indicated, complete with door.

.5 Sequence phase bussing such that circuit breakers shall be numbered vertically in consecutive order. Each breaker shall be identified with a circuit number.

2.6 MANUFACTURERS

.1 Acceptable manufacturers: Cutler Hammer, Federal Pioneer, Square D, and Siemens.

Part 3 Execution

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface-mounted panelboards on U-channels. Where practical, group panelboards on common length of U-channel.

.3 Mount panelboards to height indicated in Section 26 00 10, unless otherwise indicated.

.4 Connect loads to circuits as indicated.

.5 Provide a separate neutral for each branch circuit with the exception of:

.1 Split wired parking or kitchen countertop receptacles

.2 Balanced three-phase lighting circuits.

.3 Convenience receptacle circuits in corridors or stairwells.

.6 Finish parking lot panel enclosures shall match site lighting poles.

.7 Install spare conduits from recessed panelboards in accordance with Section 26 05 34.

.8 Connect isolated ground bus in panelboards to main building grounds source or distribution secondary neutral with #2/0 AWG, green insulated ground wire, in conduit.

.9 Mount panelboard such that the top is 6’-0” (1.83m) above finished floor.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 26 00 10 – Basic Electrical Materials and Methods

.2 Section 26 05 34 – Conduits

.3 Section 26 05 29 – Fastening and Supports

Part 2 Products

2.1 LOCATION

.1 Locate splitters, junction and pullboxes as indicated or as needed for each system.

2.2 SPLITTERS

.1 Sheet metal enclosure and hinged cover, suitable for locking in closed position.

.2 Main and branch lugs, shall match required size and number of incoming and outgoing conductors, as indicated.

2.3 JUNCTION AND PULLBOXES

.1 Sheet steel construction with screw-on flat covers for surface or recessed mounting.

.2 Covers with 1" (25mm) minimum extension all around, for flush-mounted pull and junction boxes.

.3 Cat-type with gasketted covers where exposed to weather.

2.4 CABINETS

.1 Type E: sheet steel, hinged door and return flange overlapping sides, handles, lock and catch, for surface-mounting.

.2 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing ¾" (19mm) GIS fir plywood backboard. Cabinets shall be flush or surface-mounted as indicated.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Install splitters as indicated and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

.3 Use splitters only where indicated on the drawings.

3.2 JUNCTION, PULLBOXES AND CABINETS

.1 Install pullboxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 74" (1.9m) above finish floor.

.3 Install terminal blocks, as indicated.

.4 Provide pullboxes in conduit runs as described in Section 26 05 34.

.5 Boxes and cabinets shall be installed plumb and square with building lines.

.6 Install junction and pullboxes clear of all mechanical duct work and piping.

.7 Junction and pullboxes shall be sized to C.E.C.

3.3 IDENTIFICATION

.1 Identify splitters with Size 5 nameplates.

.2 Identify junction and pullboxes with Size 1 nameplates.

.3 Identify cabinet with Size 5 nameplates.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 26 00 10 – Basic Electrical Materials and Methods

.2 Section 26 05 35 – Outlet Boxes and Fittings

1.2 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 26 00 10.

Part 2 Products

2.1 SWITCHES

.1 Toggle-operated general purpose AC switches 15A and 20A, 120V AC and 347V AC, single pole, double pole, three-way and four-way switches as indicated, with the following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver alloy contacts.

.3 Urea molding.

.4 Suitable for back and side wiring.

.5 Confirm colour with Architect, Interior Designer or Consultant.

.6 Fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.2 Switches of one manufacturer throughout project.

.3 Switches shall be premium specification grade (Industrial spec grade or Commercial grade).

.4 Acceptable Manufacturers:

Manufacturer	120 Volt	347 Volt
Hubbell	1200 Series	18200 Series
Leviton	1200 Series	54500 Series
Pass & Seymour	15AC1 Series	3715 Series
Copper Wiring Devices	1200 Series	18201 Series

2.2 RECEPTACLES

.1 Duplex receptacles, NEMA No. 5-15R, 125V AC, 15A, U-ground with the following features:

.1 Nylon face. Confirm colour with Architect, Interior Designer or Consultant.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Triple wipe contacts and riveted grounding contacts.
Cooper Wiring Devices: BR Series – Commercial Grade #5252 Industrial Grade – 5 wire contacts, terminal covers, one piece grounding system.

.2 Single receptacles NEMA No. 5-15R, 125V AC, 15A, U-ground, with the following features:

.1 Nylon face. Confirm colour with Architect, Interior Designer or Consultant.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Receptacles shall be identified isolated ground type where indicated by triangle. Confirm with Architect, Interior Designer or Consultant. Provide a separate insulated ground wire for each isolated ground circuit.

.4 Receptacles shall be of one manufacturer throughout project.

.5 Acceptable Manufacturers: Hubbell, Copper Wiring Devices, Bryant, Woodhead, Pass & Seymour. Catalogue No. 5252 for all manufacturers.

2.3 SPECIAL WIRING DEVICES

.1 Special wiring devices: as indicated on drawings.

.2 Pushbutton stations shall be flush or surface-mounted as required. Units shall be complete with up/down, or start/stop buttons, as required and green pilot light.

.3 Range outlets shall be NEMA# 14-50, 125/250V, 50A,complete with cord set.

.4 Dryer outlets shall be NEMA #14-30, 125/250V, 30A, complete with cord set.

.5 Power poles shall be Emergi-lite #STD/9’6”/W/LC/VP102/RD/AF, complete with telephone and power sections, two duplex receptacles, 10’ (3m) cord and adjustable foot. Color shall be white. Provide a receptacle in the ceiling space for unit to plug into.

.6 Floor mounted pedestal-type receptacle shall consist of a 5” (127mm) square low profile, 2-piece fitting with steel frame with black housing and 2 duplex receptacles. Bottom plate shall be complete with knockout and AC-90 connector for centered installation.

.7 Floor mounted, pedestal-type combination telephone/receptacle shall consist of a 5” x 10” (127 x 250 mm), low profile, 2-piece fitting with steel barriered frame with black housing with two duplex receptacles and space for two Amphenol jack connectors. Bottom plate shall be complete with AC-90 connector in power section and slot for conduit entry in telephone section.

.8 Floor mounted, flush-type receptacle shall consist of a Hubbell #BA-2529 round formed steel shallow concrete pour box, #SA-3925 round cover (aluminum) and duplex receptacle.

2.4 OCCUPANCY SENSORS

.1 General:

.1 Sensors shall control lighting in the sensed area only.

.2 The Contractor shall be responsible for a complete, operable system, and installation should be warranted for a period of one year after acceptance.

.3 The product shall be warranted for a period of (5) five years.

.4 The Contractor shall, when supplied with drawings to mark on, provide As-Builts to The city, noting the location of lighting zones, sensors, power packs and low voltage wire.

.5 Occupancy sensors shall be installed as per manufacturer's recommendations.

.6 Specific low voltage wire surface routing shall be approved by the Contract Administrator.

.7 Sensor and control unit manufacturer must have experience in the lighting controls industry equal to minimum of (5) years with a minimum of (5) five similar projects.

.8 Contractor shall be responsible for contacting the manufacturer for proper placement and adjusting of sensor.

.9 To ensure quality and reliability, sensors shall be manufacture red by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

.10 Occupancy sensors shall be CSA or cUL listed.

2.5 COVERPLATES

.1 Coverplates from one manufacturer throughout project.

.2 Stainless steel coverplates for wiring devices mounted in flush-mounted outlet boxes.

.3 Sheet steel utility box cover for wiring devices installed in surface mounted utility boxes.

.4 Cast gasketted coverplates for wiring devices mounted in surface mounted FS or FD-type conduit boxes.

.5 Weatherproof double lift spring-loaded cast aluminium coverplates, complete with gaskets for duplex receptacles as indicated.

.6 Weatherproof coverplates, complete with gaskets for single receptacles or switches as indicated.

.7 Confirm colour of Phenolic plates (if used), with Architect, Interior Designer or Consultant.

Part 3 Execution

3.1 INSTALLATION – SWITCHES

.1 Install single throw switches with handle in “UP” position when switch closed.

.2 Install switches in gang-type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height specified in Section 26 00 10 or as indicated.

3.2 INSTALLATION – RECEPTACLES

.1 Install receptacles in gang-type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles vertically at height specified in Section 26 00 10, or as indicated.

.3 Install cord sets on ranges and dryers.

3.3 INSTALLATION – COVERPLATES

.1 Install suitable common coverplates where wiring devices are ganged.

.2 Do not use coverplates intended for flush outlet boxes on surface mounted boxes.

.3 Provide a coverplate on each outlet.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 26 00 10 – Basic Electrical Materials and Methods

.2 Section 26 24 16 – Panelboards

1.2 SUBMITTALS

.1 Submit product data in accordance with Section 26 00 10.

.2 Include with requests for equal, time-current characteristic curves for breakers with ampacity of 800A and over, or with interrupting capacity of 25,000 symmetrical RMS and over at system voltage.

1.3 BREAKERS – GENERAL

.1 Bolt-on molded case circuit breaker, quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C (104°F) ambient.

.2 Common-trip breakers with single handle for multi-pole applications.

.3 Magnetic instantaneous trip elements in circuit breakers, to operate only when the value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-10 times current rating.

.4 Circuit breakers with interchangeable trips as indicated.

1.4 THERMAL MAGNETIC BREAKERS

.1 Molded case circuit breaker shall operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping under overload conditions and instantaneous magnetic tripping for short circuit protection.

1.5 GROUND FAULT CIRCUIT INTERRUPTERS

.1 Molded case circuit breakers as above with integral Class A Group 1 ground fault interrupter.

1.6 ARC FAULT CIRCUIT INTERRUPTERS

.1 Where indicated on drawings, supply arc fault circuit interrupters (AFCI) or arc fault circuit interrupters with ground fault circuit interruption (AFCI w/GFCI). The breaker shall provide parallel arc detection and protection in addition to overload and short-circuit protection. AFCI breakers shall be “classified for mitigating the effects of arcing faults” or conforming to UL Standard 1699 and as defined by Article 210-12 of Section A of the 1999 NEC.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable manufacturers: Cutler Hammer, Federal Pioneer, Square D, Siemens.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 26 00 10 – Basic Electrical Materials & Methods

.2 Section 26 06 21 – Mechanical Equipment Connections

.3 Section 26 24 19 – Motor Control Centres

1.2 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 26 00 10.

.2 Indicate:

- .1 Mounting method and dimensions.
- .2 Starter size and type.
- .3 Layout of identified internal and front panel components.
- .4 Enclosure types.
- .5 Wiring diagram for each type of starter.
- .6 Interconnection diagrams.

1.3 OPERATION AND MAINTENANCE DATA

.1 Provide data for incorporation into Maintenance Manual specified in Section 26 00 10.

.2 Include operation and maintenance data for each type and style of starter.

1.4 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 26 00 10.

- .1 4 contacts, stationary.
- .2 4 contacts, movable.
- .3 2 contacts, auxiliary.
- .4 2 control transformers.
- .5 2 operating coils.
- .6 2 fuses.
- .7 10 indicating lamps.
- .8 OA kit.

Part 2 Products

2.1 MATERIALS

.1 Starters: to CSA C22.2 No. 14, EEMAC E14-1.

.1 Starters smaller than EEMAC "1" are not acceptable.

.2 EEMAC/NEMA rated type only – IEC type not allowed.

2.2 MANUAL MOTOR STARTERS

.1 Single-phase and three-phase manual motor starters of size, type, rating, and EEMAC "1" enclosure with components as follows:

.1 Switching mechanism, quick make and break.

.2 Overload heaters, manual reset, trip indicating handle.

.2 Accessories:

.1 Toggle switch.

.2 Indicating light.

.3 Locking tab to permit padlocking in "ON" or OFF" position.

.4 Flush-mounted type for public areas or as indicated.

2.3 FULL VOLTAGE MAGNETIC STARTERS

.1 Magnetic of size, type, rating and EEMAC "1" enclosure with components as follows:

.1 Contactor solenoid operated rapid-action type.

.2 Motor overload protective device in each phase, manually reset from outside enclosure.

.3 Power and control terminals.

.4 Wiring and schematic diagram inside starter enclosure in visible location.

.5 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.6 Control transformer.

.2 Accessories:

.1 Pushbuttons and selector switches labelled as indicated.

.2 Two indicating lights:

.3 RED – "OFF" and GREEN – "ON

.4 Two N/O and two N/C spare auxiliary contacts, unless otherwise indicated.

.5 HOA selector switch.

2.4 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage, as indicated and 120V secondary, complete with secondary fuse, installed within starter enclosure.

.2 Size control transformer for control circuit load plus 20% spare capacity.

2.5 FINISHES

.1 Apply finishes to enclosure in accordance with Section 26 00 10.

2.6 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 00 10.

.2 Identify manual starters with Size 2 nameplates, indicating motor number, description and horsepower.

.3 Identify magnetic starters with Size 4 nameplates, indicating motor number, description, horsepower and voltage.

2.7 MANUFACTURERS

.1 Acceptable manufacturers are: Westinghouse Canada Inc., Square D Company Limited, Allen Bradley Canada Company, Siemens Canada Ltd., and Cutler Hammer Canada Limited.

Part 3 Execution

3.1 INSTALLATION

.1 Install starters, connect power and control as indicated.

.2 Install correct fuses and overload devices.

3.2 TESTS

.1 Perform tests in accordance with Section 26 00 10 and manufacturer's instructions.

.2 Operate switches and contactors to verify correct functioning.

.3 Perform starting and stopping sequences of motors and controls.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

.5 Ensure that motor rotation corresponds with the direction required by the driven equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Drawings and general provisions of the Contract, including general and supplementary conditions and Division 01 specification sections, apply to this section.

1.2 REFERENCES

.1 Comply with common work results for electrical, section 26 05 00 and all other documents referred to therein.

1.3 SUBMITTALS

.1 Submittals:

.1 Submit shop drawings for all products as follows:

.1 Provide complete, fully dimensioned detail drawings including all major components and details fabrication of each fixture type.

.2 Provide requisite schematics and plans indicating assembly and installation of components. Submit complete photometric data prepared by an independent testing laboratory for luminaires where specified for approval by Consultant.

.3 Submit shop drawings and product data in accordance with Section 26 00 10. Shop drawings shall include luminaire lamp type, ballast and/or driver data including manufacturer name and model number, for each luminaire type. Include total luminaire power consumption including ballast and/or driver losses, voltage, base type, and order codes. Lamp data shall include color temperature, and CRI.

.4 Maintenance manuals shall include a list of replacement lamps, ballasts and/or drivers for each luminaire. Include manufacturer data including name and model number, lamp type. Voltage, wattage, base type and order code. Lamp data shall include color temperature and CRI.

1.4 QUALITY ASSURANCE

.1 ALL components TO BE APPROVED/LISTED AND LABELLED BY AN APPROVED AGENCY.

1.5 DELIVERY, STORAGE AND HANDLING

.1 All lighting equipment shall be individually packaged with sufficient, protective padding for the selected method of transport. All handling and shipping shall be performed in accordance with the equipment manufacturer's recommendations. Unopened containers shall be stored in a protected location.

1.6 WARRANTY

.1 Provide Contractor warranties as well as factory warranties. All equipment and labor in this Contract shall be free from defects in products or workmanship for 24 months after substantial completion.

.2 Drivers shall be warranties for a minimum of 5 years with a minimal hour of operation of 50,000 hours.

1.7 WORK INCLUDED

.1 Provide all light fixtures, poles, and auxiliary equipment as required for a complete installation.

.2 THIS Contractor is responsible for releasing orders and coordinating deliveries of the light fixtures from the suppliers in order to adhere to the construction schedule. This Contractor is responsible for receiving, handling and storing all light fixtures until ready for installation.

.3 Inspect deliveries to ensure they are complete.

.4 Install all electrical light fixtures including common area light fixtures, as per Contract documents.

1.8 SOURCE QUALITY CONTROL

.1 The Manufacturer of all products specified herein must have been engaged in the fabrication of the equipment for at least the past 5 years.

.2 The light fixtures listed in the light fixture schedule are pre-approved and are the standard of acceptance to be met through quality, performance, and architectural design.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Acceptable fixture manufacturers are as listed in the luminaire schedules.

2.2 GENERAL

.1 Luminaires shall carry the csa label.

.2 Where soffits or ceilings have thermal insulation, provide fixtures which are csa approved for such use.

.3 Provide new lighting fixtures complete with mounting accessories, junction boxes, trims, lamps and drivers as specified and per attached fixture cut sheets.

.4 All 347 volt luminaires shall be complete with integral disconnect switch to meet cec part 1 rule 30-308(4).

.5 Drivers or ballasts used in exterior luminaires shall be rated at -40°c starting.

.6 Fixture type catalogue numbers do not necessarily denote required mounting equipment or accessories. Provide complete mounting accessories appropriate for each mounting condition.

.7 All fixtures shall be installed with a frame or canopy that is compatible with the ceiling type specified by the consultant.

.8 Provide appropriate accessories for proper mounting of all fixtures. Include plaster frames for plaster ceiling and firestop protection for fixtures in rated ceiling. For fixtures suspended from ceiling, provide pendants or aircraft cables complete with accessories to complete the installation as indicated on the drawings.

.9 If the words “equivalent” or “approved equal” are not indicated after light fixture manufacturer and catalog number in the fixture schedule, no other manufacturer will be acceptable for that particular type.

.10 Re-lamp all fixtures to be re-used.

.11 Any unused fixtures above the ceiling must be removed and circuits terminated. Turn fixtures over to The city.

2.3 FIXTURE FINISHES

.1 ALL custom colour finishes are to be approved by the consultant team.

2.4 LIGHTING FIXTURE SCHEDULE

.1 Catalogue numbers in the luminaire schedule are shown to indicate approved manufacturer and fixture quality requirements.

2.5 EXTERIOR LIGHTING

.1 Supply and install exterior lighting as indicated in the luminaire schedule and as shown on the drawings complete with poles, arms, light fixtures, anchor bolts and setting template, nut covers and other accessories necessary for proper installation. Finish all metal surfaces with zinc chromate primer, and finish paint as directed by the consultant.

.2 Drivers or ballasts used in exterior luminaires shall be rated at -40°c minimum operating temperature.

2.6 WIRE GUARDS

.1 Provide wire guards to all fixtures that are mounted so that any part of the fixture is less than 8'-0" above adjacent floor, unless noted otherwise in the luminaire schedule.

Part 3 Execution

3.1 INSTALLATION – GENERAL

.1 Lighting fixtures shall be installed as indicated on architectural reflected ceiling plans, Electrical Drawings and per approved shop drawings.

.2 Lighting fixtures shall be installed in accordance with fixture manufacturers written instructions, applicable requirements of the consultant, applicable authorities, and with recognized industry practices.

.3 Verify locations and spacing of lighting fixtures with reflected ceiling plans and notify Consultant of any variance or conflict between the plans and field conditions. Do not proceed until conflict has been resolved.

.4 Work shall be coordinated with other trades. Lighting fixture locations shall have priority over location of ducts, diffusers, sprinklers, smoke detectors and other non-structural obstructions.

.5 All fixtures shall be supported directly from the building structural members or from bridging attached to the structural members by rod hangers and inserts. Provide all necessary hardware and blocking to ensure that fixtures hang true, square, plumb, and in proper alignment.

.6 Where continuous rows of lighting are recessed or surface mounted individual fixtures shall be tightly butted together such that no gaps are visible.

.7 Where fixtures are mounted between architectural features shop drawings shall be provided indicating installation length and mounting method.

.8 Fixtures installed in suspended T-bar ceiling shall be equipped with suspension chains, securely fastened to fixture and slab above. The light fixture shall be centered in the ceiling grid opening. Provide a minimum of two chains, one each on diagonal opposite corners, and provide more chains if required by local authority having jurisdiction.

.9 Where lighting fixtures are stem hung from ‘ball and socket’ swivels at the ceiling, use stranded wire, #16 AWG (19 x 29) minimum size from outlet box to the fixture.

.10 Where lighting fixtures are chain-suspended, use solid conductor in armored cable or flexible conduit and secure to chain with white or clear nylon cable ties.

.11 All fixtures shall be installed with the bottom of the fixture housing aligned with the finished ceiling line unless otherwise noted in manufacturers installation instructions.

.12 Support recessed linear fixtures by four hangers per fixture minimum independent of ceiling structure or tee bars unless ceiling system is designed to carry the fixtures.

.13 Provide wiring channel for mounting of fixtures and wiring in between fixtures, suspended below mechanical piping, ductwork, etc., as directed on 0.6"(152mm) rigid conduit or 0.4" (100mm) galvanized rod hangers, on 8 ft.(2500mm) centers.

3.2 INSTALLATION OF LINEAR FIXTURES

.1 Linear fixtures, surface mounted or suspended, shall not have more than ¼"(305mm) variation in alignment for any 15'-0" (4.6M) run.

3.3 INSTALLATION OF TRACK LIGHTING

.1 In spaces with parallel rows of track, all track shall be installed such that neutral conductors and feeds have the same orientation.

3.4 FIELD QUALITY CONTROL

.1 Operate each fixture after installation and connection. Each fixture shall be inspected for proper connection and operation.

.2 Perform testing of operation of temporary or emergency power systems.

.3 Verify that all lenses, louvres, baffles, fixture trim cones, diffusers and other parts are thoroughly cleaned in a manner recommended by the manufacturer.

3.5 LUMINAIRE WIRING

.1 Connect recessed luminaries to outlet boxes with 4" (100mm) flexible conduit and 90 Degrees C wire.

.2 Provide dedicated neutral for all luminaires dimmed or connected to a lighting control system.

3.6 FIXTURES IN SERVICE ROOMS

.1 Before mounting any fixture in mechanical, electrical or other service room. Layout must suit equipment limitations in the room.

3.7 ADJUSTMENTS

.1 All adjustable fixtures shall be aimed as instructed by the Consultant. Personnel, lifts, and ladders shall be provided as required.

3.8 CLEANING

.1 All unnecessary equipment, materials, wiring, and fixtures shall be removed from those areas affected by the construction. Materials that are not part of the lighting or electrical distribution system shall be removed from the Site.

.2 All lighting fixtures shall be cleaned in a manner approved by the manufacturer and shall be free of dirt and debris upon completion of installation.

3.9 PROTECTION

.1 Lighting fixtures, once installed, shall be protected from damage during the remainder of construction period.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 26 00 10 – Basic Electrical Materials and Methods

.2 Section 26 05 34 – Conduit

.3 Section 26 05 19 – Wire and Cable

.4 Section 26 05 35 – Outlet Boxes and Fittings

1.2 SUBMITTALS

.1 Submit shop drawings in accordance with Section 26 00 10.

.2 Data shall indicate system components, mounting method, source of power and special attachments.

1.3 OPERATION AND MAINTENANCE DATA

.1 Provide data for incorporation into Maintenance Manual specified in Section 26 00 10.

.2 Operation and Maintenance Manual shall include:

.1 Operation and maintenance instruction s for complete battery system to permit effective operation and maintenance.

.2 Technical data – illustrated parts lists with parts catalogue numbers.

.3 Copy of approved shop drawings.

1.4 MAINTENANCE MANUALS

.1 Provide maintenance manuals in accordance with Section 26 00 10.

.2 Include:

.1 Five spare lamps for remote heads.

1.5 WARRANTY

.1 Provide a written guarantee. Stating that the battery for emergency lighting is guaranteed against defects in material and workmanship for a period of ten years, with a no-charge replacement during the first five years and a pro-rat charge on the second five years from the date of the Final Acceptance from The city.

1.6 SYSTEM DESCRIPTION

.1 Supply voltage: 120 AC

.2 Output voltage: 24 DC

.3 Battery: long life sealed lead, maintenance-free.

.4 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected, modular constructed.

.5 Solid state transfer.

.6 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

.7 Signal lights: solid state, life expectancy 100,000 h minimum, for “AC Power ON” and “High Charge”.

.8 Lamp heads: integral on unit and remote as indicated. Adjustable mounting, swivel type, complete with tungsten-halogen lamp.

.9 Cabinet: suitable for shelf mounting to wall and complete with knockouts for conduit.

.10 Auxiliary equipment:

- .1 test switch
- .2 battery disconnect device
- .3 AC input and DC output terminal blocks inside cabinet
- .4 shelf
- .5 cord and plug connection for AC
- .6 RFI suppressors

Part 2 Products

2.1 REMOTE HEADS

.1 Lamp heads: 360° horizontal and 180° vertical adjustment.

.2 Lamps: 20W, MR16, 100-hour.

.3 Enclosure: square, surface mounted, frosted vandal-resistant, Lexan cube diffuser, single or double units as indicated.

.4 Enclosure: square, surface mounted, clear polycarbonate cover, single or double units as indicated, in crawlspace only.

.5 Lumens shall meet min;10 Lux average and not less than 1 Lux as per NBC 3.2.7.3.

Part 3 Execution

3.1 INSTALLATION

.1 Install unit equipment for emergency lighting in accordance with latest CSA document.

.2 Install conduit and wiring as indicated.

.3 Install unit equipment and remote mounted fixtures as indicated.

.4 Cut and re-cap cord to remove surplus.

.5 Direct heads as indicated.

.6 Mount double remote heads on outlet box such that the two heads will be horizontal with the building lines.

.7 Wire and connect in the exit lights, so equipped, to the battery system as indicated.

.8 Charge the batteries and test the system for proper operation (minimum of 35 minutes discharge time).

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFICATIONS

.1 Section 26 00 10 – Basic Electrical Material and Methods

.2 Section 26 05 29 – Fastenings and Supports

.3 Section 26 05 35 – Outlet Boxes

1.2 SYSTEM DESCRIPTION

.1 Exit lighting shall identify exits and means of egress.

Part 2 Products

2.1 EXIT LIGHTS

.1 Exit lights: to CSA C22.2 No.141-10 and CSA C860.

.2 Housing: cold rolled steel minimum.

.3 Lamps: LED-2.5W 120v or 347 V.

.4 Operation: designed for over 100,000 hours of continuous operation.

.5 Pictogram: Units supplied with two pictogram film per face for directional selection.

.6 Two-wire universal AC input: 120 to 347V ac,

.7 Two wire standard DC input: 6 to 24V dc.

.8 Universal mounting – end, wall or ceiling.

.9 Manufacturers:

.1 Lumacell

Part 3 Execution

3.1 INSTALLATION

.1 Install exit lights as indicated, in accordance with MBC-1011, NRCAN C860.

.2 Connect exit lights to exit light circuits as indicated.

.3 Connect emergency connection to emergency circuits as indicated.

.4 Ensure that exit light circuit breaker is locked in on position.

.5 Wiring for exit light circuits shall be installed in a separate conduit system.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute

.1 ANSI J-STD-607-A-2002, Joint Standard - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.

.2 Telecommunications Industries Association (TIA)/Electronic Industries Alliance (EIA)

.1 TIA/EIA-606-2002, Administration Standard for the Commercial Telecommunications Infrastructure.

.3 U.S. Department of Labour/Occupational Safety and Health Administration (OSHA)

.1 Nationally Recognized Testing Laboratory (NRTL).

1.2 SYSTEM DESCRIPTION

.1 Telecommunications grounding and bonding system consist of grounding busbars, bonding backbones, and other bonding conductors.

.2 Provides ground reference for telecommunications systems within building and bonding to it of telecommunications rooms.

.3 Metallic pathways, cable shields, conductors, and hardware within telecommunications spaces are bonded to telecommunications grounding and bonding system.

1.3 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.2 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)

.1 Predrilled copper busbar, approved by NRTL, electrotin plated with holes 8mm diameter for use with standard-sized lugs to ANSI J-STD-607-A.

.2 Dimensions 6mm thick, 100mm wide, 400mm long to ANSI J-STD-607-A .

2.2 TELECOMMUNICATIONS GROUNDING BUSBAR (TGB)

.1 Predrilled copper busbar, approved by NRTL, electrotin plated with holes 8mm diameter for use with standard-sized lugs to ANSI J-STD-607-A .

.2 Dimensions 6mm thick, 50mm wide, 300mm long to ANSI J-STD-607-A.

2.3 BONDING CONDUCTOR FOR TELECOMMUNICATIONS

.1 Copper conductor, green insulated marked to: ANSI J-STD-607-A sized as per Item 2.6 Table 1.

2.4 TELECOMMUNICATIONS BONDING BACKBONE (TBB)

.1 Copper conductor, green insulated marked to ANSI J-STD-607-A sized as per Item 2.6 Table 1.

2.5 GROUNDING EQUALIZER (GE)

.1 Copper conductor, green insulated marked to: ANSI J-STD-607-A sized as per Item 2.6 Table

2.6 SIZING OF BONDING CONDUCTORS

Table 1 - Conductor Sizing

Linear Length ft (m)	Size (AWG)
Less than 13’ (4m)	6
14-20’ (4-6m)	4
21-26’ (6-8m)	3
27-33’ (8-10m)	2
34-41’ (10-13m)	1
42-52’ (13-16m)	1/0
53-66’ (16-20m)	2/0
Greater than 66’ (20m)	3/0

2.7 WARNING LABELS

.1 Non-metallic warning labels in English and French to ANSI J-STD-607-A.

.2 Identify labels with wording "If this connector is loose or must be removed, please call the building telecommunications manager".

Part 3 Execution

3.1 TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)

.1 Install TMGB in entrance room on insulated supports 50 mm high at location close to electrical power panel if one is installed in same room as indicated.

.2 Install 3/0 AWG copper bonding conductor from TMGB to alternating current equipment ground (ACEG) of serving electrical power panel (panelboard).

3.2 TELECOMMUNICATIONS GROUNDING BUSBAR (TGB)

.1 Install TGB in main terminal/equipment room and each telecommunications room.

.2 Install 3/0 AWG copper bonding conductor from TGB to alternating current equipment ground (ACEG) of serving electrical power panel (panelboard).

3.3 BONDING CONDUCTORS GENERAL

.1 When placed in ferrous metallic conduit or EMT longer than 1m, bond to each end of conduit or EMT using grounding bushing.

3.4 BONDING CONDUCTOR FOR TELECOMMUNICATIONS

.1 Install bonding conductor for telecommunications from TMGB to service equipment (power) ground.

.2 Use approved 2 hole compression lugs for connection to TMGB.

3.5 TELECOMMUNICATIONS BONDING BACKBONE (TBB)

.1 Install TBBs from TMGB to each TGB as indicated.

.2 Use approved 2 hole compression lugs for connection to TMGB and TGBs.

3.6 GROUNDING EQUALIZER (GE)

.1 Install GE between TBBs in multi-storey building by bonding TGBs with GE on top floor and every third floor in between top and bottom floors.

3.7 BONDING TO TMGB

.1 Bond metallic raceways in telecommunications entrance room to TMGB using #6 AWG green insulated copper conductor.

.2 For cables within telecommunications entrance room having shield or metallic member, bond shield or metallic member to TMGB using #6 AWG green insulated copper conductor.

.3 Bond equipment rack and cabinets located in telecommunications entrance room to TMGB using #6 AWG green insulated copper conductor.

3.8 BONDING TO TGB

.1 Bond metallic raceways in telecommunications room telecommunications equipment room to TGB using #6 AWG green insulated copper conductor.

.2 For cables within telecommunications room having shield or metallic member, bond shield or metallic member to TGB using #6AWG green insulated copper conductor.

.3 Bond equipment racks and cabinets located in telecommunications room equipment room to TGB using #6 AWG green insulated copper conductor.

3.9 LABELLING

.1 Apply warning labels to telecommunications bonding and grounding conductors.

.2 Apply additional administrative labels toTIA/EIA-606.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 74 19 – Construction/Demolition Waste Management and Disposal

.2 Section 26 05 34 – Conduits

.3 Section 26 05 36 – Cable Tray

1.2 SYSTEM DESCRIPTION

.1 Empty telecommunications raceways system consists of outlet boxes, cover plates, terminal and distribution cabinets, conduits, cabletroughs, pull boxes, sleeves and caps, fish wires, service poles, service fittings, concrete encased ducts.

.2 Cabletray distribution system.

1.3 WASTE MANAGEMENT DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal all packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal, conduit, and wiring materials from landfill to metal recycling facility as approved by Contract Administrator

.5 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 MATERIAL

.1 Conduits: In accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 Underground cable ducts: In accordance with Section 33 65 76 - Direct Buried Underground Cable Ducts.

.3 Cabletroughs: In accordance with Section 26 05 36 - Cable Trays for Electrical Systems.

.4 Overhead distribution system: in accordance with Section 26 27 23 - Indoor Service Poles.

.5 Underfloor distribution system: in accordance with Section 26 05 39 - Underfloor Raceways for Electrical Systems.

.6 Cellular floor raceways: in accordance with Section 26 05 38 - Cellular Metal Floor Raceway Fittings.

.7 Junction boxes, cabinets type E T: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

.8 Outlet boxes type, conduit boxes size, and fittings: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

.9 Indoor service poles: in accordance with Section 26 27 23 - Indoor Service Poles.

.10 Fish wire: polypropylene type.

Part 3 Execution

3.1 INSTALLATION

.1 Install empty raceway system, including underfloor overhead distribution system, fish wire, terminal cabinets, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, cabletroughs, service poles, miscellaneous and positioning material to constitute complete system.

.2 Install components as indicated and in accordance with the requirements of the system manufacturers.

.3 Install polypropylene pull cords in all empty conduits.

.4 Coordinate location of desk mounted equipment with millwork supplier.

.5 Conduit sizes to manufacturer’s recommendations.

3.2 IDENTIFICATION

.1 Identify all pathway to Section 27 05 53.

.2 Identify cabinets with size 5 nameplates.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 27 05 28 – Pathways for Communication Systems

.2 Section 27 13 13 – Communications Copper Backbone Cabling

1.2 REFERENCES

.1 EIA/TIA 606.

1.3 SYSTEM DESCRIPTION

.1 Clearly label all conduit raceways pullboxes.

.2 Clearly label all communication cabling and outlets including CCTV, Voice, Data, PA/Intercom, Nurse Call, CATV and Satellite TV.

Part 2 Products

2.1 CONDUIT IDENTIFICATION

.1 Colour code coverplates of junction boxes in conduit systems as per the colour code list below.

.2 Colour code by spray painting the coverplate on each junction box in the conduit run.

.3 In addition to colour coding coverplates on junction boxes with power wiring, the circuits being run in the box shall be identified on the inside coverplate the permanent felt marker.

.1	120/208V Normal Power	Yellow
.2	120/208V Emergency Power	fluorescent red
.3	347/600V Normal Power	orange
.4	347/600V Emergency Power	fluorescent orange
.5	Fire Alarm	red
.6	Telephone	purple
.7	Security	royal blue
.8	CCTV	black
.9	Ground	green
.10	PA/Sound	brown
.11	Nurse Call	sky blue
.12	Controls	white

.13	Satellite or Cable TV	fluorescent green

2.2 CABLE IDENTIFICATION

.1 Identify all cables with numbered markers at both ends. Transfer identity number to markup drawing for record purposes.

.2 Identify optical fibre and copper riser cable at the following locations;

.1 at all points where cable enters or leaves conduit or tray

.2 at termination points

.3 at regular intervals on long or exposed runs

2.3 OUTLET IDENTIFICATION

.1 Clearly identify all communication outlets with direct thermal transfer adhesive print tape. Labels shall be white with black letters.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 26 00 10 – Electrical General Provisions

.2 Section 27 05 26 – Grounding and Bonding for Communication

.3 Section 27 05 28 – Pathways for Communication

.4 Section 27 21 23 – Data Communication Switches and Hubs

1.2 CODES AND STANDARDS

.1 CAN/CSA-T529 (TIA/EIA 568-D.2) – Commercial Building Telecommunications Standard (Cabling, Terminations, etc.)

.2 CAN/CSA-T528 (TIA/EIA 606-C) – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings (labelling)

.3 CAN/CSA-T530 (TIA/EIA 569) – Commercial Building Standards for Telecommunications Pathways and Spaces (Supports)

.4 CAN/CSA-T527 (TIA/EIA 607) – Grounding and Bonding for Telecommunications in Commercial Buildings.

.5 IEEE, FCC Standards – Data System Performance Standards

.6 IEEE standard 1100 – Powering and Grounding Sensitive Electronic Equipment

.7 Manitoba Building Codes (Fire Ratings, Wall Penetration, etc.).

.8 CAN/CSA C22.1 Section 60.

.9 Government of Manitoba Heritage Building Construction

1.3 CONTRACTOR QUALIFICATION

.1 Only experienced SCS Contractors will be considered for the work. Sub-contracting of the SCS, copper and/or fibre, must be requested and approved (if acceptable) in writing prior to tender/bid closing.

.2 Contractor will be trained and authorized by the manufacturer they represent. Include evidence of certification, training and references with bids.

.3 Contractor will own and maintain tools and test equipment for the installation and testing of the connectivity components. Provide with tender/bid a list indicating type and manufacturer of all test equipment to be used.

1.4 PERFORMANCE

.1 Performance: Guaranteed minimum performance requirement for installed system will be channel bandwidth power sum up to 250 MHz, including Alien Crosstalk

Suppression (AXT) and Near-End Crosstalk (NEXT), supporting high-bandwidth UTP applications such as 1 Gbps Ethernet (IEEE802.3ab) and scalable for 10GBASE-T and PoE++ systems.

.2 Performance headroom should be included in all test results to ensure optimal signal quality.

Part 2 Products

2.1 CABLING

.1 Cabling: Unshielded Twisted Pairs (UTP). Media specifications contained in this section reflect the physical characteristics of UTP media, Compliant with TIA/EIA 568-D.2 (2022) standards, commonly known as Category 6.

.2 Construction: Eight (8) single, solid annealed copper conductors, 23 AWG, formed into 4 individually twisted pairs and enclosed by an overall jacket rated CSA FT6, and/or cUL equivalent.

2.2 MODULAR PATCH CORDS

.1 Hub and/or server room: four twisted pair Category 6 stranded cable (beige, gray, black, or blue jacket/boots), tested for PoE++ compatibility complete with RJ45 modular jacks. Length of cord will be determined by Patch Panel layout drawing (minimum length is 1 meter).

2.3 MODULAR LINE CORDS

.1 Workstation: similar to Patch Cords above except 3 meters long, constructed for Category 6. All line cords must be tested to support high-bandwidth PoE++ compatibility.

2.4 POLARIZATION

.1 Generally arranged in compliance with Standard CSA-T529A.

2.5 WORKSTATION OUTLET

.1 Outlet assemblies at each workstation identified on drawings will be Category 6 modular 8-wire jacks (RJ45 type) supporting PoE++ and 10GBASE-T applications.

.2 Identify the telephone (phone icon) and data (computer icon) jacks with graphic icons. Surface mounting of pathways and outlets will be subject to approval.

2.6 EQUIPMENT ROOM (MDC) & TELECOMMUNICATIONS ROOM (IDC)

.1 Patch panels will be 24 port, 1U, black, loaded or unloaded (load with RJ45 jacks, as required). Cable strain relief will be provided for every patch panel. 1u horizontal patch cable management will be provided for every patch panel and LAN switch.

.2 Data racks shall be size and type as indicated on the drawings.

.3 Refer to detail sheets attached showing arrangement of products within rack.

.4 Use only new, unused, OEM products per drawing and/or Scope of Work for all of the Structural Cabling System. All alternates are subject to approval prior to bid closing.

2.7 MANUFACTURERS

.1 Pre-Approved manufacturers include: Commscope, Belden, Panduit

.2 All other manufacturers are subject to approval in writing prior to tender/bid closing.

Part 3 Execution

3.1 INSTALLATION

.1 Supply and install all SCS components as specified.

.2 Ensure that all plenum cabling is kept clear of all power equipment and lighting fixtures as follows, considering both the increased cable diameter and heat dissipation requirements for Category 6 PoE++ UTP:

INSTALLATION GUIDELINES

.1	Transformers up to 5 kVA	1m
.2	Power lines (120V Systems)	300mm
.3	Fluorescent lighting	300mm
.4	Power lines (600V Systems)	1m
.5	Electrical Motors	1m

.3 Bundle communications cables in transition areas between conduit and tray. Utilize data grade Velcro ties for bunching only, not for supporting weight. Bundles are not to exceed 10 – 4pr. 23awg copper cables, accounting for additional heat generated by PoE++ systems to avoid thermal buildup.

.4 Identify all cables with numbered markers at both ends. Provide cross-reference sheet showing cable number and LAN/telephone drop number. Ensure numbering schemes clearly distinguish Category 6 cabling to avoid confusion with legacy systems.

.5 Install main cabling runs over corridor areas whenever possible and/or along lines parallel to building structures. Penetrations through full-height wall partitions will be made through pre-established horizontal openings or sleeves. Supply and install non-shrinkable grout for all wall or floor penetrations in compliance with the Manitoba Building Code.

.6 Install cabling in ceiling plenum spaces in cable tray if indicated or support by means of 'B-Line' J-hooks complete with metal retainers at a maximum of 1.2 meter intervals to ensure that the cable is free from tension over its entire length. Support by cable ties to existing structures will only be approved by written consent of the Engineer/Designer. Only use suspended ceiling support wires according to Standard. The cable(s) will be independently supported over the entire length. Refer to detail sheet attached.

.7 Protect all cable installations from mechanical damage.

.8 Perform cable installation and termination methods in a manner that will not degrade the cable specification (e.g. tensile, bend radius). All terminations will be inserted by use of the proper tool. Use of the "dust cap" to effect insertion will not be considered adequate. Bundling, supporting, stripping of outer jacket and retention of wiring twist will be subject to the final approval of the Engineer. Work not meeting the above criteria must be re-done.

.9 Label all cables, etc. as indicated on drawings and/or according to 'Identification' addressed in this specification.

.10 Fire stopping of all penetrations shall be as per the project Fire Stopping specifications, and as identified on the drawings.

.11 Fit all conduit ends including vertical stubs with insulated grommets or bushings.

.12 Where the use of concealed vertical conduit is required, provide a minimum outlet box size of 4"Wx4"Hx2.5"D complete with a single mud ring as required. For metallic surface conduit, provide double gang FS boxes. For surface conduit, provide plastic latching duct complete with Category 6 fittings and boxes.

.13 Minimum EMT conduit size for new conduits is 1 inch to accommodate up to 6 Category 6 cables. See 'conduit sizing' in the Standards listed, indicating the numbers of cables allowed.

.14 Utilize 'B-Line' drywall plates in hollow wall construction to allow maximum cable space in the wall cavity. Install faceplate vertically where ever possible. Provide insulated bushings or grommets where cables are dropped into steel stud wall cavities. Provide a small loop of cable in the cable before entering wall cavities.

.15 All vertical cables will be secured at each floor level with approved strain relief equipment. Support bundles of cables splitting of the harness with Velcro straps, wirewraps and/or nylon ties.

.16 During installation, do not suspend data cable coils from the structure by means of nylon ties or equivalent. Properly support these coils to prevent damage. Cables will not rest on the ceiling grid and tiles.

.17 Avoid excessive slack cable as this increases run length.

.18 All communication equipment (actives or passives, in use or not) will be protected from construction dust etc. (e.g. drywall sanding) until after the project is complete.

If any equipment is in use, provide adequate ventilation and co-ordinate an approved procedure with the Client.

.19 Prior to installation, review the drawing with the person(s) in charge on site and walk through to confirm exact locations of all workstation outlets, communication equipment and all other construction and components.

.20 Bond (and ground) all metallic enclosures, conduits, boxes, and metallic cables associated with the cable installation in compliance with C.E.C. Section 10, ANSI/TIA-607-D, and C.S.A. T527 to ensure minimal signal interference.

.21 All cables buried in ground will be accompanied by a continuous metallic tape installed a minimum of 305mm above cables. Burial depth of cables will be a minimum of 610mm below grade unless specified on drawing otherwise. These cables will be shielded and will utilize Category 6 lighting arrestors at both ends.

.22 The Contractor will be courteous, provide quality workmanship, pay attention to detail and clean up during and after construction.

.23 The SCS Contractor's Supervisor on site will be trained by the manufacturer of the product being installed.

.24 Obtain work permits, as required, from the authority having jurisdiction for SCS installations.

3.2 IDENTIFICATION

.1 Provide appropriate identification at all workstations, racks, patch plates, intermediate distribution closet doors, and main distribution closet doors. Labels must explicitly indicate "Category 6" and whether they are PoE++ capable. Use labels compliant with ANSI/TIA-606-C standards for telecommunications infrastructure administration.

.2 PoE++ capable labels must include 'PoE++' in bold black font on a yellow background.

.3 Utilize an electronic label maker (e.g. Brother, Dymo) printed on yellow self-adhesive ribbon with black lettering sized as indicated. Thoroughly clean the area where the label is to be applied with alcohol or equivalent cleaner to remove dirt and grease. Labelling will not smear.

.4 Workstation:

.1 4*A01 (6mm lettering on faceplate and top of floor pedestal, see drawing attached). 4 indicates floor level of the MDC or IDC.

.1 B – basement

.2 1 – first/main/ground level

.3 M – mezzanine

.4 Etc.

* variable identifier for use with multiple closets per floor.

(N = north, S = south, W = west, E = east, * = only one closet/floor)

A patch plated identifier

01 sequential code for patch plate port, match OEM

.2 In addition, identify the telephone jacks and data jacks with the appropriate graphic icon.

.5 Intermediate Distribution Closet

.1 IDC4* (18mm lettering on door frame and rack)

IDC Intermediate distribution closet

4 indicates floor level of rack

* variable identifier for use with multiple closets per floor (as above)

.2 Horizontal Patch Plate – identify first plate as Horizontal (12mm)

A Patch plate identifier (12mm lettering on left side of plate)

01 sequential port number (6mm lettering under port unless OEM numbering is existing)

.3 Backbone Patch Plate – identify first plate as Backbone (12mm)

MDCA01 (6mm lettering under port)

MDC Main distribution closet

A01 port 01 from patch plate A in MDC

.6 Main Distribution Closet

.1 MDC (18mm lettering on door frame and rack)

.2 Backbone Patch Plate – identify first plate as Backbone (12mm)

A patch plate identifier (12mm lettering on left side of plate)

01 sequential port number (6mm lettering under port unless OEM numbering is existing)

3.3 TESTING

.1 Test in accordance with EIA/TIA Category 6 568-D.2 Permanent Link, including testing for alien crosstalk, insertion loss, return loss, propagation delay, and skew, critical for PoE++ and 10GBASE-T systems. Patch and line cords will be stored in the appropriate MDC/IDC. Test only after the patch panel and workstation jacks are installed in their ‘permanent’ fixtures.

.2 Stray noise testing should identify sources of electromagnetic interference (EMI) and provide recommendations for mitigation if detected.

.3 Test and record the length (in meters) of all horizontal and backbone communication structured cabling.

.4 Provide test results (individual workstation and backbone drops) in electronic format; latest version of Microsoft Word or unlocked PDF file. Also provide test

summary sheets on paper. Identify which drops are backbones on the summary sheets.

.5 The tester/testing criterion is as follows:

.1 Tester Kit must be UL classified to be in full compliance with the TIA Accuracy Level II specification for the Permanent Link.

.2 Tester Kit must have been calibrated/re-calibrated within one year prior to the test results submitted. Provide a dated paper copy of the calibration/re-calibration report. Include serial number(s), firmware version and date of manufacture (not purchase date). An accredited laboratory that is traceable to NIST must have completed the calibration/re-calibration.

.3 Only special adapters by the OEM of the Tester Kit are allowed together with the patch and line cords for the site to perform the Channel Level II Link Test.

.4 Test results must show 'headroom' for each cable drop.

.5 NVP must match the cable manufacturer's actual percentage, not the default setting of the tester.

.6 Test reports must be from the latest version of software/firmware capable of verifying Category 6 compliance, including advanced metrics such as alien crosstalk, power delivery integrity for PoE++ systems, and headroom measurements for signal quality.

.7 Tester Kit must test for stray noise on the cable drop prior to doing the test.

3.4 CERTIFICATION

.1 The installation Contractor will support the above system for a period of one year from the date of acceptance by the Engineer. The response time to troubleshoot and begin repairs of reported failures will be four (4) hours within the City of Winnipeg. If the failure is a result of installation and/or performance of structured cabling, the failure will be repaired within 24 hours from the time of the report. If the failure is not installation and/or performance of structured cabling, the Contractor will contact the person in charge and/or technical resources prior to repairs (after troubleshooting) to confirm and get approval to proceed. The contractor will make the effort to co-ordinate and get approval to proceed prior to any site visit.

.2 The contractor will be locally 'Certified' by the Manufacturer of the structured cabling components installed. The Manufacturer will warranty the installation and performance of those components for a minimum of 15 years after date of acceptance by the Engineer. Provide documentation in support of certification and warranty specific to this project/site. Upon completion of the Structured Cabling System installation, copper and/or fibre, the contractor will supply and install the framed Certificate or plaque from the manufacturer on the inside wall of the room containing the MDC, right beside the door, easily visible, 6'6" above the floor.

.3 The manufacturer warranty must explicitly cover PoE++ performance for the duration of the warranty period.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 26 00 10 – Electrical General Provisions

1.2 CODES AND STANDARDS

.1 CAN/CSA-T529 (EIA/TIA568-A) - Electrical Installations

.2 CAN/CSA-T528 (EIA/TIA606) - Wiring Systems Administration

.3 CAN/CSA-T527 (EIA/TIA607) - Telecommunication Pathways and Spaces

.4 CAN/CSA-T527 (EIA/TIA607) – Commercial Building Grounding/Bonding/Requirements

.5 EIA/TIA, IEEE, FCC Standards - Data System Performance Standards

.6 IEEE Std. 1100 - Powering and Grounding Sensitive Electronic Equipment

.7 Manitoba Building Codes (Fire Ratings, Wall Penetration, etc.).

.8 CAN/CSA C22.1 Section 60.

.9 Obtain work permits as required by authority having jurisdiction for all communications structured cabling system installations.

1.3 CONTRACTOR QUALIFICATION

.1 Only experienced Communication Installation Contractors shall be considered for the work. Contractors may be asked to provide evidence of having performed work of a similar type as specified. Subcontracting of electrical and/or fibre installation must be requested and approved (if applicable) in writing prior to tender/bid closing.

.2 Contractor shall be trained and authorized by the manufacturers they represent. Include evidence of certification and references with bids. Subcontracting of the certification must be requested and approved (if applicable) in writing prior to tender/bid closing.

.3 Own and maintain tools and equipment for the successful installation and testing of the copper and fibre cabling system. Provide list of the type and manufacturer of all test equipment to be used. Include with bid.

1.4 TENDERED EQUIPMENT LIST

.1 Prepare a printed form listing the various materials as well as the manufacturer's name, catalogue numbers, if any, and the supplier’s name, upon which the bid was prepared. Include with bid. All product utilized must be supported by at least three (3) certified installers in Winnipeg.

.2 Identify any and all Subcontractors used to assist in the completion of this work on the Tendered Equipment List.

1.5 "AS-BUILT" DRAWINGS

.1 Supply "As-Built" Drawings to Client within seven (7) working days after confirmation by The city/ Contract Administrator that the construction is complete and the deficiencies (if any) have been corrected.

Part 2 Products

2.1 CABLING (COPPER - UTP)

.1 Cabling: Unshielded Twisted Pairs. Generally, the U.T.P. Media specifications contained in this section reflect the physical characteristics consistent with the UTP media, commonly known as Category 6.

.2 Construction: Eight (8) single, solid annealed copper conductors, 23 AWG, formed into 4 individually twisted pairs and enclosed by an overall jacket rated CSA FT4 (FT6 for air-plenums) or cUL equivalent. Cable construction to be determined by the manufacturer to ensure compliance with the cross-talk and delay-skew requirements of the above standard.

2.2 CABLING (COPPER – MULTIPAIR)

.1 Outdoor Application: Outlook cable shall be 24AWG Multipair, UTP cable of gel-filled construction and be installed via buried ducts. Cable shall be terminated via solid state lightning protectors at both ends.

.1 Where the cable termination point is greater than 50 feet from where underground cable enters a building or service tunnel provide a splice enclosure to transition from underground gel-filled cable to FT4 rated armoured cable.

.2 Where the cable termination point is less than 50 feet from where the underground cable enters a building or service tunnel, provide EMT conduit entrance facilities for the underground cable from the point the cable enters the building or service tunnel to the Main Distribution Closet (MDC).

.2 Indoor Application: Cabling shall be 24 AWG multipair, UTP, FT4 rated. Cable shall meet or exceed all TIA.EIA, Category 3 requirements. All pairs shall be individually twisted and all contained in a single jacket.

.1 Soft jacket cable shall be used only when the cable path will provide protection to the cable for the entire length of the run (conduit).

.2 Armoured jacket cable shall be used in all cases where the cable path will not necessarily provide complete protection to the cable (J-hooks, or tray). Armour shall be bonded to the telecommunications ground bus bar using a #6 AWG green insulated conductor at the designated source end only.

2.3 APPROVALS

.1 Equipment and routing of all riser cables shall be approved by the Contract Administrator.

.2 The Contractor shall provide the Contract Administrator with a list showing the manufacturer for each type of cable used on the project. All like materials shall be from one manufacturer to ensure compatibility.

2.4 CONNECTORS

.1 Termination of all copper riser cables shall be as indicated on the design detail drawing provided.

Part 3 Execution

3.1 INSTALLATION

.1 Supply and install all communication cables and associated termination components as previously specified.

.2 Ensure that all plenum cabling is kept clear of all power equipment and lighting fixtures as follows:

.1 INSTALLATION GUIDELINES

.1	TRANSFORMERS UP TO 5kVA	= > 1M
.2	POWER LINES (120V Systems)	= > 300mm
.3	FLUORESCENT LIGHTING	= > 300mm
.4	POWER LINES (600V Systems)	= > 1M
.5	ELECTRICAL MOTORS	= > 1M

.3 Bundle communication cable in transition areas between riser sleeves and tray. Utilize data grade Velcro ties for bunching only, not for supporting weight. Bundles are not to exceed 10 – 4pr. 24AWG copper cables

.4 Identify all cables with numbered markers at both ends. Transfer identity number on to mark-up drawing for record purposes.

.5 Ensure that all equipment is constructed to the Standards specified above. All like materials shall be by a single manufacturer.

.6 No splicing, tapping or bridging devices will be used between specified connecting hardware and outlet assemblies.

.7 Protect all cable installations from mechanical damage.

.8 Label all cables generally as indicated on drawings and adhere to EIA/TIA 606 standard.

.9 Fit all conduit ends including vertical stubs with insulated grommets or bushings.

.10 Use approved cable clips or hangers at 1.2m centres to effectively support all horizontal multi-cable harnessing. All vertical cables shall be secured with approved strain relief equipment. Support bundles of cables splitting off of the harness with Velcro straps, or wirewraps.

.11 During installation, do not suspend data cable coils from the structure by means of nylon ties or equivalent. Properly support these coils to prevent damage.

.12 Avoid excessive slack cable as this increases run length.

.13 Prior to installation, review the drawing with the person(s) in charge on site and walk through to confirm exact locations of all construction components. If there are any major discrepancies, contact Contract Administrator.

.14 Bond (and 'ground') all metallic enclosures and metallic cables associated with the cable installation in compliance with C.E.C. Section 10 and C.S.A. T527. Check with Contract Administrator regarding 'ground loops'.

.15 The riser system shall be as specified to link the Cross-Connect Room to the Horizontal Cross-Connects in the telecommunication closets on each floor. The total system shall be cabled in Star Topology. It shall consist of the riser transmission media between the above locations and the associated hardware terminating media.

.16 Adequate riser sleeve space will be available and/or will be re-enterable in all communication closets.

.17 Complete layout documentation of all wire closets and the cross connect frame shall be provided to the Contract Administrator upon substantial completion of the project.

.18 Manufacturers recommended bending radius for the cable, during installation and after installation must be complied with.

.19 Carefully monitor cable tensions during installation. Observe manufacturer recommended maximum pulling tension for each type of cable installed.

.20 Vertical riser cables shall be secured at frequent intervals as specified on detailed drawings of approved strain relief equipment. Frequency of vertical support shall depend on the number of floors spanned.

.21 After installation is complete there should be no tensile force on the cable is that of its own weight.

.22 During installation protect the cable from kinks, crimps, sharp edges or any area where the cable may be crushed.

.23 Do not route cable unsupported over (or support cable by) pipes, conduit, ceiling grid, or other cabling.

.24 Do not run fibre optic cable in same conduit or sleeve as copper wiring.

.25 Do not pull cables through LB fittings. Where changes of direction are necessary within raceways proper radius bends shall be used. Install pullboxes in straight sections of conduit.

.26 Bond all metallic enclosures associated with the cable installation in compliance with C.E.C. Section 10.

.27 Dust caps must be utilized whenever cables or devices are not immediately connected.

3.2 TESTING

.1 Test for continuity, pair placement, pair reversal and incorrectly terminated cables. Test to Channel Level II compliance in accordance with EIA/TIA 568A-TSB-67. Patch and line cords must be left inserted into jacks after the test has 'passed'.

.2 Test and record in tabular form the following for each outlet:

.1 Wire Map

.2 Length

.3 Propagation delay

.4 Delay skew

.5 Attenuation.

.6 N.E.X.T. and F.E.X.T.

.7 N.E.X.T. at remote end

.8 Resistive impedance.

.9 Power sum and return loss testing for all pairs.

.3 Test and record the length in meters of all horizontal and backbone communication structured cabling.

.4 An experienced communication installer in compliance with Clause 1.3.1 shall perform the above testing.

.5 Provide full test output (and backbone drops) in electronic (test-file) format; latest version of Microsoft Word for Windows (E-mail, CD or DVD) or E-mail Adobe Acrobat PDF file. Also provide test summary sheets on paper. Identify which drops are backbone on the summary sheets.

3.3 CERTIFICATION

.1 The Installation Contractor will support the above system for a period if one year from the date of acceptance by the Contract Administrator. The response time to troubleshoot and begin repairs of reported failures will be four (4) hours within the City of Winnipeg. If the failure is a result of installation and/or performance of structured cabling, the failure will be repaired within 24 hours from the time of the report. If the failure is not installation and/or performance of structured cabling, the Contractor will contact the Building Manager to confirm and get approval to

proceed. The Contractor will make the effort to co-ordinate and get approval to proceed prior to any site visit.

END OF SECTION

Part 1 General

1.1 MATERIALS

.1 All equipment shall be new and CSA approved.

.2 Switches shall be manufactured by Cisco and shall be suitable for use with the application. Bandwidth and throughput of switches shall be determined by the supplier of each system.

Part 2 Products

2.1 INSTALLATION

.1 Equipment shall be turned over to The City for configuration and installation.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 26 00 10 – Basic Electrical Materials and Methods

.2 Section 26 15 10 – Voice/Data Communications Horizontal Cabling Category 6

1.2 CODES AND STANDARDS

.1 CAN/CSA-T529 (Electrical Installations).

.2 CAN/CSA-T528 (Wiring Systems Administration.

.3 IEEE Std. 1100 (Powering and Grounding Sensitive Electronic Equipment.

.4 EIA/TIA, IEEE, FCC Standards (Data System Performance Standards).

.5 Manitoba Building Codes (Fire Ratings, Wall Penetration, etc.).

.6 CAN/CSA C22.1 Section 60.

.7 Obtain work permits as required by authority having jurisdiction for all data installations.

1.3 CONTRACTOR QUALIFICATION

.1 Only experienced Data Installation Contractors will be considered for the work. Contractors must be able to provide evidence of having performed work of a similar type as specified.

.2 All personnel employed in the installation of these systems shall be adequately trained in the use of such equipment and testers.

Part 2 Products

2.1 MATERIALS

.1 All equipment shall be new and CSA approved.

.2 Contractor shall provide all hardware required for the mounting of WAP.

.3 Provision of WAPs is by the City of Winnipeg.

.4 Provide WAP connections for all locations designated on drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Supply and install all WAPs and associated equipment as previously specified.

.2 Locate all WAPs as indicated on drawings. Install WAPs at high level below ceiling. Communication outlets for WAPs shall be installed above ceiling level.

.3 Supply and install patch cord of required length between communication outlet and wireless access point.

.4 Confirm exact mounting locations and heights for all WAPs with Consultant prior to installation.

3.2 SOFTWARE SETUP

.1 All WAP software shall be setup by City of Winnipeg IT Staff prior to site installation by Electrical Subcontractor.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Basic Electrical Materials and Methods Section 26 00 10

.2 Conduits Section 26 05 34

.3 Outlet boxes, conduit boxes and fittings: Section 26 05 35

1.2 SHOP DRAWINGS

.1 Submit shop drawings and product data in accordance with General Electrical Requirements Section 26 00 10.

.2 Include:

.1 Layout of equipment and equipment interconnection.

.2 Complete wiring diagrams with equipment schematics.

1.3 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for the system and incorporate into the manual as specified in Section 26 00 10 Electrical General Requirements.

.2 Include:

.1 Operation and Maintenance Instructions to permit effective operation and maintenance.

.2 Copy of approved shop drawings.

1.4 WARRANTY

.1 All equipment shall be warranted by the manufacturer to be free of defects in material and workmanship for a period of one (1) year from the date of invoice.

.2 Installation of equipment shall be warranted by the installing Contractor, to be free of defects for a period of one (1) year from the date of invoice.

1.5 SUBSTITUTIONS

.1 Substitutions to the equipment specified will not be accepted unless written approval has been given prior to the bid closing date by the Contract Administrator.

.2 Requests for approval must be made in writing, to the Contract Administrator, at least seven (7) calendar days prior to the bid date.

.3 Substitute proposals shall include all items of labour, material and equipment required for the installation of the substitute equipment including all changes in conduit, wiring, etc.

.4 Each bidder proposing to use substitute equipment, shall advise the Contract Administrator, at least seven (7) calendar days prior to the bid date, of changes required to wiring, conduit, backboxes and terminal cabinets, in order to utilize the proposed equipment. Failure of bidder to notify the Contract Administrator of such changes, will make the bidder responsible for ANY additional costs necessary to make the proposed system function as specified.

1.6 ON-SITE INSTRUCTION

.1 The system supplier shall provide on-site instruction to familiarize personnel with the operational techniques and procedures for the system.

.2 The time frames for the instructional sessions are to be selected at a time convenient to The city.

Part 2 Products

2.1 CCTV CAMERA SPECIFICATIONS

.1 The camera shall be Hanwha Network Camera / Wisenet Compatible.

.2 The cameras shall be capable of recording up to full HD (1080P) resolution but scalable to suit the final requirements of the client.

.3 Cameras shall be rated for the application in which they are installed as per the project drawings. Provide indoor, outdoor, 360-degree view etc including all required mounting hardware for each camera to suit the location identified on the drawings.

.4 All cameras shall be dome type with integrated, aesthetically designed housings. Use of external enclosures or large mounts is not permitted.

.5 Approved manufacturer: Hanwha/Wisenet

2.2 NETWORK VIDEO RECORDER

.1 The Network Video Recorder shall provide a high-end recorder capable of storage and play back of images from 1 to 24 camera inputs at 30 frames per second (NTSC) refreshing simultaneous recording rate, and posses external watchdog capability for system lock-up, duplex operation, water marking of each frame and posses internal video motion detection.

.2 The network video recorder shall meet or exceed the following design and performance specifications:

.1 The digital recorder shall be Hanwha Embedded NVR / Wisenet Compatible 16/32/64 Channel Recorder

.2 The network video recorder shall be continuous recording, including motion detection and store memory onto a hard drive and have RAID 6 array

archiving capability storing video images in a variation of sizes from 213 GB to 657 GB hard drive per unit.

.3 The digital recorder shall provide 8, 16,video camera inputs at a recording rate of 30 frames per second (fps), (NTSC) or 24 fps (PAL). Digital recorder shall have capability of networking together over TCP/IP protocol and expanding to an unlimited number of cameras connecting to the overall system.

.4 The network recorder shall provide live and playback viewing at any viewing station connected to the network without stopping the recording process of any video input.

.5 The network recorder shall provide 1 SVGA output for each unit and allow all networked viewing stations simultaneous control of any image without interrupting the recording process of influencing the operation of any other viewing station.

.6 The network recorder shall provide full remote control via TCP/IP network protocol and addressing through an RJ-45 LAN port allowing for the connection of a computer and connection to a LAN or WAN network. Two 9-pin D-type connectors for COM 1 and 2 ports shall also be provided. System shall also provide 6-pin Mini-DIN connector for a PS/2 mouse and keyboard also, provide a 15-pin D-Type port for a PC monitor connection and a 25-pin D-Type port for Printer connection.

.7 The network recorder shall provide three modes of recording: 1) Continuous 24 hours per day, 2) scheduled recording in a weekly format, 3) event recording activated by video motion detection. The system shall also allow for scheduled recordings and event recordings to be combined in a normal operation.

.8 The processing unit shall provide ISO 9001 certification and utilize MPEG-1 compression technology and be based on video streaming technology.

.9 The network recorder shall provide built in network video motion detection for every camera in the system and allow the operator the capability to set areas in the picture for motion activity. The system shall have a search feature allowing for the movement of a specific object in the recorded video and be able to scan at 24-hour recording in approximately 15 minutes for the detection of a specific object moving.

.10 The network recorder shall provide the mounting of the unit in an EIA standard 19" rack.

.11 The network recorder shall provide, as an option purchased separately, an on line UPS capable of operating for a minimum 30 minutes preventing shut down of the system that was not performed by an authorized user.

.12 The network recorder shall provide four SCSI connections for storage units.

.13 The network recorder shall Hanwha Embedded NVR / Wisenet compatible 16/32/64 channel recorder or approved equal.

2.3 STORAGE UNIT

.1 The storage unit shall be external to the processing unit and shall utilize SCSI hard drives in a RAID array.

.2 The storage unit shall meet or exceed the following design and performance specifications:

.1

.1 All Storage drives must be designed for “Surveillance” use, no exceptions (Seagate Skyhawk, Western Digital Purple)

.2 The storage unit shall provide 3, 6 or 9 hard drive configurations, depending on the video storage needs. With each hard drive being a minimum 73GB or larger.

.3 The storage unit shall provide for multiple storage units to be connected to the processing unit allowing for expansion of the system.

.4 The storage unit shall be housed in an industrialized casing and measure 7 inches in height and mount in an EIA 19" rack.

.5 The storage unit shall provide for normal operating temperature range of 32° - 104°F (0°-40°C) and 85% relative humidity non-condensing.

.6 The total quantity of storage shall be 30 days of full playback at 15 FPS and full HD resolution.

2.4 VIEW STATION

.1 Viewing of the CCTV system shall be through networked access at any PC in the facility. Refer to floor plans for pre-determined locations of computers to be readily available for CCTV viewing.

2.5 VIDEO ENCODER

.1 Hanwha 16 channel encoder / Wisenet compatible.

2.6 VIDEO DECODER

.1 Hanwha 64 channel dual HDMI video decoder / Wisenet compatible.

2.7 CLIENT SOFTWARE

.1 The integrator shall install the proprietary Client Software onto the View Station or if the view station is provided by the manufacturer, the software shall be pre-installed as part of the package..

2.8 AUTHENTICATION SOFTWARE

.1 The authentication software shall be an optional program utilized for the verification of recorded video images to ensure that they are the original content.

.2 The authentication software shall meet the following specifications:

.1 The authentication software shall provide for the analysis of the video stream to be original and unaltered. The software shall analyze frame-by-frame and verifying the water marking to be present and un-altered or manipulated.

2.9 CABLE

.1 All cable shall be low-loss type and sized as per the electronics manufacturer's recommendations. All cable supplied shall conform to local electrical codes.

.2 All cabling must be cUL/CSA approved, FT6 Rated Cabling

.3 Device Wiring – Category 6 cabling

.4 Terminations must be TIA/EIA-568-B. Cabling must terminate to Cat6 Patch Panels, Keystone

.5 Jacks, Terminal boxes, and interconnected with Cat6 Patch Cables to devices. No concealed joints or terminations are permitted

.6 Camera Terminations must be made in Hanwha Back Boxes, Junction Boxes, and must be accessible for servicing equipment

.7 All Cabling and terminations must be tested and verified, with documented test results.

Part 3 Execution

3.1 WIRING

.1 Install all wiring as indicated on the drawings.

.2 Wiring shall be sized to conform to the exact requirements set forth by the equipment manufacturer.

.3 Splicing of system wiring shall be accomplished only in equipment back boxes, terminal cabinet or designated junction boxes.

.4 System wiring shall not share the same conduit, raceway, wire-way or back box with cable from other systems.

.5 All exposed cable ends shall be dressed properly with heat shrinkable tubing.

3.2 INSTALLATION

.1 Division 26 shall employ a duly qualified systems Contractor to supply, install, wire and commission the system as specified.

.2 Provide conduit raceway as required by the systems Contractor.

.3 The system shall be complete in all respects to operate satisfactorily and to the satisfaction of the Contract Administrator.

.4 The entire system shall be installed in conduit and al conductors shall be colour coded.

.5 Installation of equipment shall conform to manufactures specifications and adhere to CSA/cUL/ULC guidelines.

.6 Equipment Layout and Panel board configuration shall follow City of Winnipeg guidelines.

3.3 TESTING

.1 Perform tests in accordance with section 26 00 10 Electrical - General Requirements.

.2 Perform tests in the presence of The City and/or the Contract Administrator.

3.4 TRAINING

.1 Furnish the services of a factory-trained equipment representative for one(1) one hour period for training of operational/user personnel, and for one(1) one hour period for training of maintenance personnel.

.2 Representatives shall be thoroughly familiar with all aspects of system theory, operation, installation, programming and maintenance.

.3 Training of maintenance personnel shall include operation, fault identification and trouble-shooting of each system.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 26 00 10 – Basic Electrical Materials and Methods

.2 Section 27 05 28 – Pathways for Communication

.3 Section 27 21 23 – Data Switches and Hubs

1.2 SYSTEM DESCRIPTION

.1 System shall provide audio and visual communication from multiple exterior door stations to the interior master stations at the reception desk and Office 216.

.2 System operates such that when the call button is pressed at the station, a tone sounds intermittently at both master stations. By operating the appropriate selector button on the master station, video and hands-free voice communication may occur between stations. There shall be a door release button on the master station which will release the selected door station associated door electronic lock momentarily to permit entry to building. The call can be cancelled by operating the cancel button on the master station.

.3 Upon release of the door hardware, the door station shall make a visual and audible signal to identify that the door has been released.

1.3 SUBMITTALS

.1 Submit shop drawings and Maintenance Manuals in accordance with Section 26 00 10.

Part 2 Products

2.1 VIDEO ANSWERING STATION

.1 The Aiphone IX-MV7-B Master station includes a 7" video display, speaker/microphone, touchscreen for answering calls and releasing doors.

.2 Master station unit to be desk-mounted and wired and connected to both power and door intercom station head end.

2.2 DOOR STATION

.1 The door station shall be Aiphone IX-DV

.2 Door stations shall also include all door release hardware and connections to door intercom station head end and card access system to temporarily release door controls to allow entry by door release signal from master station.

.3 Components to be mounted on stainless steel surface plate and shall be complete with a surface mounting kit suitable for the exterior cladding of the building. Coordinate requirements on a door-by-door basis.

2.3 POWER SUPPLY

.1 The Aiphone IX Series Intercom is powered over POE.

.2 Provide 1U PoE switch matching other switch manufacturers in project to supply Aiphone equipment. Refer to section 27 21 23 – Data Switches and Hubs.

2.4 WIRING

.1 Provide all required conduit and wiring between the master and door station and the power supply and the master station.

.2 Provide all interconnection relays between door hardware (electric strikes, magnetic locks) and card access equipment to temporarily release door to allow entry.

.3 Provide all field wiring to ensure properly functional system.

.4 Door control cabling and wiring shall be in conduit throughout.

.5 Where surface conduits are required, Contractor shall submit a layout to the Consultant for review and approval prior to installation.

2.5 ACCEPTABLE MANUFACTURERS

.1 Aiphone IX series Peer to Peer IP Video Intercom System

Part 3 Execution

3.1 MASTER STATION

.1 Install, wire and connect master station as indicated.

3.2 DOOR STATION

.1 Install, wire and connect door station at the loading dock entrance.

3.3 POWER SUPPLY

.1 Install, wire and connect power supply as indicated.

3.4 TESTING

.1 Test all functions and components for proper operation in accordance with manufacturer’s recommendations.

3.5 TRAINING

.1 Provide two (2) four hour training sessions on AI Phone use. One (1) for Maintenance staff and one for users.

.2 Training shall be with approved staff only.

.3 Training shall be completed before Substantial Completion.

END OF SECTION

Part 1 General

1.1 SYSTEM ARCHITECTURE AND DESCRIPTION

.1 The system shall provide and integrate, at a minimum, the following major functions:

- .1 Access Control (Doors, Elevator Floors, Equipment)
- .2 Alarm Monitoring and Control
- .3 Management Reporting

.2 The system shall provide fully featured access control and alarm monitoring capabilities for large or small facilities, utilizing intelligent remote controllers which are programmable from any web browser based device on the Customer's network (or the internet) that supports a web browser. From the web browser, it must be possible to set up the operational mode of the controllers, user's access permissions, and other parameters as required to control building access and security. In addition, the system must have the capability to configure and monitor a large number of access points and alarm inputs at remote locations and report the alarm condition to any web browser enabled workstation on the network.

.3 The system shall be user-friendly, providing a user interface that allows end-users with very little knowledge of computers to be trained to configure and maintain the system, and to respond to alarm conditions in an intuitive manner with minimum keystrokes.

.4 The main menu shall indicate the following functions:

- .1 Status Screens:
  - .1 The status screens shall provide a view of the equipment in the system. The screen will show the current status of the on-line remote intelligent controllers. The following information shall be displayed in real-time:
    - .1 Digital Inputs (DI) status of remote intelligent controllers
    - .2 Digital outputs (DO) status of remote intelligent controllers
    - .3 System alarms of remote intelligent controllers
    - .4 Door alarms
    - .5 Communication status
- .2 Menu Tree Icon:
  - .1 The menu tree window shall display a graphical hierarchical tree of the menu structure, main menu, sub-menus and functions. The menu tree shall provide way of selecting sub-menus and data entry screens and invoking functions.

.5 The system shall be made up of, at a minimum, the following major components:

- .1 Server (primary web server and fileserver)

.2 Workstations (any device on the network that supports a web browser)

.3 TCP/IP based network

.4 Remote (networked based) intelligent control (RIC)

.5 Reader connector module (RCM)

.6 Input connector module (ICM)

.7 Output connector module (OCM)

.8 Elevator (lift) connector module (ECM)

.9 Field devices and sensors

.6 Each of these major components shall be integrated to operate as a fully-function, complete turnkey systems solution.

.7 The system shall be based on a distributed processing architecture which is implemented as follows:

.1 The server and web browser based stations shall provide for distributed system control and monitoring for administrators and/or operators on the customer's network. Any or all system administration and operator tasks shall be handled from any web browser based workstations. Alarms and events may be routed to, enunciated and displayed at any combination of workstations. The server shall communicate with the remote intelligent controllers (RIC) via the TCP/IP network.

.2 The RIC must contain a local data base with pertinent information for control of its associated end device through an appropriate connector module. The RIC must be able to operate in a stand-alone fashion, making all decision locally. The RIC must send a heartbeat signal so the server knows that the RIC is operating normally. A system of polling the RIC is not acceptable.

.3 Data entry, system management functions, and alarm handling and processing shall be performed at any of web browser based workstation on the network. The network shall be based on TCP/IP.

.4 All system operating data shall be stored at the server. Any web browser based workstation on the network shall be capable of accessing and editing this data, dependent only upon the operator's authority levels.

.5 The server shall provide non-volatile storage of the operating system software, the application systems software, the user databases, and the alarm, event and transaction data files. A hard disk shall be provided at the server as the primary mass memory storage device.

.6 The system shall have modular expansion capabilities in that additional RIC's may be added to the system without software upgrades or further field hardware revisions.

.7 The system shall possess true real-time, multi-user and multi-tasking capabilities.

.8 The system shall, at a minimum, support up to 100,000 users, 10,000 RIC's,

10,000 access readers, 10,000 alarm input points, and 10,000 digital relay output points.

.9 The system shall provide for time programmable and real time arming and disarming of alarm points, opening and closing of door/gates/turnstiles, and the activation and deactivation of digital relay outputs.

.10 Each operator on the system shall be assigned a login password and a privilege level. A privilege level shall be made up of a group of specific programming activities.

.11 Components can be added to the system without the need to upgrade the server software.

Part 2 Products

2.1 SYSTEM ARCHITECTURE

.1 The system shall consist of two levels of intelligence, the server and remote intelligent controllers (RIC).

2.2 SYSTEM COMPONENTS

.1 Access Control Systems:

.1 2 Door Network Controller: Mercury LP1502

.2 Access Control Cabinets Pre- Wired with Power Supply:

.1 Altronix Trove T2M7XK1D – Accommodates up to 6 Mercury Controllers (12 Doors)

.3 Proximity Card Readers:

.1 HID Signo Multi Class Reader – 40NKS-00-000000

.2 HID Signo Multi Class Reader – 20NKS-00-000000

.4 Request to Exit Sensor

.1 Bosch – DS150i

.2 Bosch – DS160 – with sounder and adjustable latch time

.5 Electric Strikes

.1 HES 5000 Series – Low Profile Cylindrical Lockset Strike

.2 HES 9000 Series – Surface Mounted RIM Exit Strike (9400 Low profile, 9600 Standard Profile)

.3 HES 1006CS Series – Direct Replacement for Von Duprin 6211

Part 3 Execution

3.1 SERVER

.1 Card access server is an existing Pegasus P2000 server.

.2 Contractor shall be responsible for all required modifications and programing to suit additional card access devices.

.3 Contractor shall include costing for Pegasus to do all required server programing.

.4 The server software shall be update to latest version.

3.2 REMOTE INTELLIGENT CONTROLLERS - RIC

.1 The distributed remote intelligent controllers can have firmware for:

.1 Access Control for Doors and Equipment

.2 Access Control for Elevator Floors

.3 Alarm Monitoring and Output Control

.2 The RIC shall be Mercury board micro-processor technology as per city's master security standard that can integrate with P2000 software and be able to accommodate future software upgrades, and offer completely autonomous operation as a result of its inherent intelligence and stored operating data. Standard decisions shall be made at the local level by the RIC without having to interrogate the server. Upon system initiation, it shall be possible to download all operating data and cardholder data to the RIC from the server. Upon the addition, modification or deletion of system data or cardholder information, the server shall automatically download the new data records to the pertinent RIC.

.3 RIC shall not require communication with the server except when up-loading or down-loading the database or transferring events and alarms to the server. In case of a communication failure with the server, the terminals will operate normally and buffer all transactions and alarms. When communication is re-established with the server, all buffered transactions shall be up-loaded to the server. The RIC shall provide a heartbeat so that the server knows that it is operating properly. A server polling architecture is not acceptable.

.4 RIC firmware shall be programmed in a high-level Java language for ease of maintenance and enhancement. All RIC operational codes and cardholder data must be stored in non-volatile memory. Each RIC shall contain an on-board real-time, battery backed-up clock for date/time stamping of transactions.

.5 The RIC must communicate to the server via the Customer's TCP/IP network.

.6 Each RPA shall be individually addressable by the assignment of an I.P. address. The I.P must be programmed onto a removable memory device allowing for quick address implantation in the field.

.7 The RIC shall be capable of controlling access and reporting access events and alarms simultaneously.

.8 A single RIC board shall be an intelligent door controller with its own down-loadable database. The unit shall contain all the hardware and software to perform all access control functions for one door, or one elevator reader and 265 floors, or 256 I/O points.

.9 Each RIC shall have a battery charging circuit. It shall allow automatic switching to a battery should AC power fail.

.10 Each RIC supports devices through connector modules

.11 The remote intelligent controller (RIC) will communicate to end devices through various connector modules. Depending on the firmware loaded, each RIC shall support the following connector modules:

.1 1 Card Reader Connector Module (RCM) each supporting one card reader.

.2 32 Elevator (Lift) connector module (ECM) each supporting up to 8 floors in addition the RIC connected to ECM's can support one RCM.

.3 32 Input connector modules (ICM) or output modules (OCM) input modules must have supervised inputs.

.12 Each RCM shall be capable through programming, of handling multiple reader technologies such as:

.1 Wiegand-effect

.2 Magnetic stripe

.3 Barcode

.4 Proximity, short and long range

.5 PIN keypads

.6 Reader/PIN keypad combinations

.7 AVI tag readers

.8 Biometrics readers

.13 A RIC shall have the ability to unlock a door for access and relock immediately when the door contact closes, cancelling the door time-outs. All illegal access attempts and door open time-outs shall be logged in user access records.

.14 Provisions shall exist in the RIC for separate dedicated reader-related alarms which include, but are not limited to:

.1 Door forced open

.2 Door held open

.3 Invalid card

.15 The response time from card read to door unlock shall be less than one second for normal access requests. All normal access request shall be processed locally in the RIC for fast response.

.16 Door held open time and door unlock time-out shall be user-configurable.

.17 Each RCM shall support dedicated relays for access control operations for each

door. One relay shall control the electric strike or electromagnetic locking device associated with the reader controlled door such that once a valid card has been read, the door is unlocked. A second relay shall be available for shunting foreign alarm systems or activating other special equipment.

.18 Each RCM shall be capable of supporting exit switches associated with each reader-controlled door. Activation of an exit switch (push-button, PIR, panic bar) shall release the locking device associated with that door and allow the door to open. Normal access-control time-out logic shall follow exit switch activation.

.19 Each RIC shall be capable of monitoring the door contact associated with each reader-controlled door, for break-in or door time-out processing.

.20 If an RIC determines that a cardholder is not allowed access through one of its associated doors, the door shall remain locked and an access denied alarm will be generated. If the card is presented to a reader equipped with a PIN keypad and an incorrect PIN code is entered for that cardholder, access shall be denied by the RIC and an access denied alarm will be generated.

.21 The RIC shall monitor badge reader time-outs and verify data field length in order to prevent false badge codes from being accepted.

.22 The RIC shall be locally capable of enabling/disabling alarm points based on pre-programmed time schedules, or as a result of an operator command from a workstation.

.23 A degraded or limited mode of operation at the RIC is not acceptable. The RIC must be capable of operating in a completely stand-alone fashion such that all access control decisions are made at the RIC based on a complete verification of each individual card against access control parameters and databases tables stored locally at the RIC.

.24 Each RIC shall have built-in diagnostics and an auto-restart capability for automatic start-up after power application. The RIC shall automatically change over to battery backup in the event of a power failure. Each RIC shall contain flash memory to retain memory contents even when all AC power and/or backup batter power has been removed.

.25 RIC specific alarms shall be defined for AC power loss, communication problems and tamper.

.26 Optional internal 4-hour full battery backup shall be available for complete operation of the unit after AC power failure.

.27 A watchdog timer shall be resident in the RIC to prevent noise-induced latch-up or other temporary hardware failure.

.28 RIC shall be capable of interconnecting with request to exit buttons and all other auxiliary devices shown on the drawing.

3.3 STANDARD ACCESS CONTROL

.1 All standard access control functions must be provided by the server or from the web browser based workstations which must include, but not necessarily be limited to:

- .1 Entry of access control configuration data
- .2 Entry of access control operating data
- .3 Storage of access control data
- .4 Downloading of user and configuration data to RIC
- .5 Editing of access control data
- .6 Archiving of access transactions
- .7 Retrieval of access records from RIC
- .8 Editing/display of cardholder status
- .9 Generation of management reports

.2 The system shall provide for controlling access through card reader controlled doors based on the card user's access authorization permission, which shall be definable for specific groups of readers during specific time intervals.

.3 The user information shall be entered and stored via the cardholder database. The cardholder database shall be entered through a web browser based user interface and employ the use of menus and sub-menus. The employee database shall support ten (10) user-definable fields, in addition to the standard system-supplied fields provided in order to support the access control function.

.4 The system shall, at a minimum, support up to 100,000 cardholders.

.5 For access control purposes, the system shall handle up to 32 holidays. A holiday shall be defined as fixed or variable.

.6 The system shall provide for the capability of activating and deactivating door control relays associated with reader-controlled doors via time zones or on an operator manual command basis in order to switch various doors to or from free-access status.

.7 The system shall provide for the capability to independently control the auxiliary relays in each RCM or each OCM so that a non-reader controlled door can be locked or unlocked via time zones or on a manual command basis.

.8 The system shall provide for the definition of individual reader-door operating parameters (e.g. location, unlock time, time-out) on a per reader-door basis.

.9 System update functions shall allow each remote intelligent controller (RIC) to be configured from a web browser based workstations. Additions, modifications or deletions from the user database and/or the configuration database shall automatically update all RIC's affected by the changes without further operator

intervention.

.10 The system shall provide for the capability to enable-disable users in a simple fashion using group enable and disable commands.

.11 The number of access records archived at the fileserver shall only be limited by the size of the storage device (e.g. hard disk).

.12 The system shall support 10 character reader descriptions and 10 character RIC descriptions.

3.4 ALARM MONITORING AND PROCESSING

.1 The system shall enunciate and display on a workstations three categories of alarm events:

- .1 Access alarms
- .2 Monitored alarms
- .3 System alarms

.2 The system shall provide pre-defined and user-configurable access alarms which shall include, but are not limited to:

.3 Pre-Defined. These alarms may be linked to local output relays to switch on external devices:

- .1 Door open time exceeded
- .2 Door forced open
- .3 Irregular attempts

.4 Monitored alarms originate from RIC's and can be in any one of the following states:

- .1 Alarm
- .2 Secure
- .3 Trouble

.5 Monitored alarm inputs can be linked to an output relay to activate external devices.

.6 System alarms shall include events that report communication and device failure or a system warning. System alarms shall include:

- .1 Communication failure
- .2 Cabinet tamper violation
- .3 Low battery
- .4 AC failure

.7 The system shall contain an alarm monitoring window.

.8 The alarm monitor window shall display all alarm events that are in one of the following conditions:

- .1 Active (still in alarm condition)
- .2 Unacknowledged

.3 Pending a response

.9 Acknowledged alarm that is in a secure state shall be automatically removed from the window.

.10 The following information shall be displayed: Date, Time, Type, Alarm ID, Device Description, Priority, Status and Acknowledge Time.

.11 All alarms shall remain in the alarm queue in priority order until a acknowledged by the system operator.

.12 If selected, the system archives all alarm point changes. All alarms shall be archived on the system hard disk in real-time, with date and time stamping.

.13 Alarms should be assigned a user-definable priority from between 1 and 30 per alarm queue in order to distinguish their relative importance, in the event of multiple alarms occurring simultaneously.

.14 System users shall have the capability to define the method of alarm reporting for each alarm point in the system.

.15 For each alarm point, users shall be able to link relays for equipment control. For each alarm point, the linked relay shall latch on and then be reset by an operator, or to automatically follow the alarm status, or shall pulse for a specified period of time on a change of state of the alarm point. These configuration options shall be available to the operator for each individual alarm point.

3.5 REPORT GENERATION

.1 The system shall supply comprehensive user-configurable reports for, but not limited to, the following:

.1 System configuration

.2 User

.3 Access events

.4 Activity alarms

.5 System alarms

.2 Report generation shall be simple with minimum operator actions. To generate a report, an operator will select the type of report by opening the report form, and display the report on the screen. Reports displayed on the screen may be sent to a report printer by simply clicking on an icon.

.3 Each report displayed on the screen shall be in a separate window. Therefore, multiple reports may be displayed simultaneously on the screen.

.4 The system shall support multiple report printers.

.5 All reports shall be printed in background mode and shall not interfere with normal alarm processing or alarm logging on the separate alarm printer.

3.6 SYSTEM INTEGRATION

.1 The system shall be integrated with the intrusion alarm system to accommodate arming and disarming through the use of access card.

.2 Contractor shall modify the security system as required to accommodate line item 3.6.1. Provide all modifications and hardware as required.

3.7 APPROVED DEVICES

.1 Devices noted in the products section of this specification are pre-approved for use in this work. Any deviation to the proposed products must be submitted for review prior to inclusion in the tender pricing.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 26 00 10 – Basic Electrical Materials and Methods

.2 Section 27 05 30 – Communication Raceways

1.2 CARE, OPERATION AND START-UP

.1 Refer to Section 26 00 10.

.2 Manufacturer's factory service representative to instruct:

.1 Maintenance personnel in the maintenance of system.

.2 Operating personnel in the use of system.

1.3 PROJECT DATA

.1 Submit project data in accordance with Section 26 00 10.

.2 Include riser diagram and single line diagram.

1.4 MAINTENANCE OPERATION AND DATA

.1 Refer to Section 26 00 10.

.2 Include description of system operation.

.3 Include parts list, using component identification numbers standard to the industry.

Part 2 Products

2.1 MATERIALS

.1 Conduits: to Section 26 05 19. All wiring to be in conduit.

.2 Conductors to manufacturer's requirements.

2.2 CONTROL PANEL

.1 The intrusion alarm panel shall be a Bosch B9512G.

.2 The panel shall be complete with

.1 B8108 Enclosure

.2 D101 Cabinet Lock

.3 ICP-EZTS Dual Tamper Switch

.4 D122 Battery Harness

.3 Cabinets shall be mounted no higher than 5'10" to the top of the cabinet.

.4 Cabinets shall be installed with no impedance or impairment to accessing or servicing.

2.3 KEYPAD CONTROL STATION

.1 The keypad control station shall be used to control all user functions to the control panel.

.2 The following functions shall be controlled from the keypad:

.1 Arming/disarming with L.C.D. display.

.2 Alarm memory with L.C.D. display.

.3 Zone by-passing.

.4 Trouble display.

.5 Automatic arm and disarm times.

.6 Daytime door sentry.

.7 Bell and walk test.

.8 99 user access codes.

.3 Provide 1 keypad station located as indicated on the drawings.

.4 Keypad stations shall be:

.1 Bosch B930 Alpha-Numeric Keypad (Master Keypad / Panel) complete with STI-7510F Keypad Enclosure.

.2 Keypad shall be integrated with the access control system such that the adjacent card reader identified on the drawings arms/disarms the security system when presented with a suitable proximity card.

2.4 MOTION DETECTORS

.1 Motion detectors shall be Bosch ISC-CDL1-W15 Commercial Series Tri-Tech Motion Detector complete with built-in End of Line Resistors.

.2 Confirm all mounting heights and locations with system supplier.

2.5 DOOR CONTACTS

.1 Door contacts shall be rated for use with metal framed doors. GRI 199-12W DPDT 1” Contact complete with WBox STLDRMAG Door Channel Magnet

.2 Contact switches for overhead doors shall be track mounted GRI 4700-A complete with armoured cable lead.

2.6 POWER SUPPLIES AND BATTERIES

.1 Panel Power Supply

.1 16.5 V 75VA Wire In Power Supply, CSA/cUL/ULC Listed

.2 Auxiliary Intrusion Device Power Supply

.1 Bosch B520 2A 12V Power Supply

.3 Approved Battery Type – 12V 7AH Yuasa SLA – No Substitutions

2.7 WIRING

.1 All cabling must be cUL/CSA approved, FT6 Rated Cabling

.2 Device Wiring – 22/4 Stranded or 18/4 Stranded (wire size determined by manufacturer

.3 specifications)

.4 Power Supply Wiring – 18/4, 18/2 Stranded

.5 Approved Multi-Conductor Access Control Cabling: Honeywell Profusion 3195 FT6 rated, or equivalent.

.6 Wiring for the intrusion alarm system to be installed in separate independent conduit system.

.7 Install wiring and make terminations

2.8 ZONING

.1 System to be zoned as indicated on drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Equipment Layout and Panelboard configuration must follow City of Winnipeg guidelines

.2 Provide a ¾" (19 mm) conduit from intrusion alarm control panel to main telephone backboard.

.3 Provide one 18/4 FT-4 cable in conduit from intrusion alarm control panel to fire alarm control panel.

.4 All cabling to be installed in accordance with the Canadian Electrical Code.

.5 J-Hooks are required for all cabling run in-ceiling or in free-air spaces.

.6 Cable ties are NOT permitted as a means of support.

.7 All conductors must be mechanically protected where exposed.

.8 EMT must be used for all panel interconnection, stubs, cable protection and cable pathways.

.9 PVC is not permitted.

.10 All connectors and fittings must be insulated or have threaded plastic bushings installed.

.11 All knock-outs must be fitted with an insulated bushing.

.12 All unused knock-outs must be filled with approved cover.

3.2 CERTIFICATION

.1 System to be tested under actual working conditions in the presence of, and to the satisfaction of, The city.

.2 System to be certified by manufacturer's approved representative. Submit certified test results in the Maintenance Manuals.

3.3 APPROVED SUPPLIERS

.1 Other suppliers submit for equals or alternate status, as per Section 26 00 10.

3.4 TRAINING

.1 The city training for Maintenance and Staff shall occur at turn-over of system. Initial training shall be 2 hour sessions with two follow up sessions; one within six months of training at 12 months. All costs for travel and accommodations shall be included.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 21 00 10 – Sprinkler System

.2 Section 26 00 10 – Basic Electrical Materials and Methods

.3 Section 26 05 34 – Conduit

.4 Section 26 05 19 – Wire and Cable

.5 Section 26 05 35 – Outlet Boxes and Fittings

.6 Section 26 06 23 – Elevator Wiring

1.2 REFERENCE STANDARDS

.1 Manitoba Building Code.

.2 ULC S524-19: Standard for the Installation of Fire Alarm Systems

.3 ULC S525: Standard for Audible Signaling Devices for Fire Alarm and Signaling Systems, including Accessories.

.4 ULC S526: Standard for Visible Signaling Devices for Fire Alarm and Signaling Systems, including Accessories.

.5 ULC S527: Standard for Control Units for Fire Alarm Systems

.6 ULC S528: Standard for Manual Stations for Fire Alarm Systems, including Accessories.

.7 ULC S529: Standard for Smoke Detectors for Fire Alarm Systems

.8 ULC S530: Heat Actuated Fire Detectors

.9 ULC S533: Standard for Egress Door Securing and Releasing Devices

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 26 00 10.

.2 Indicate:

- .1 Layout of equipment.
- .2 Zoning.
- .3 Complete wiring diagram, including:
  - .1 Connections to devices, FACP's, and CACF.
  - .2 Connection to sprinkler system.
  - .3 Schematics of modules.
  - .4 Central alarm and control facility layout.

.3 Submit the following manuals:

.1 General information manual.

.2 Equipment information manual.

.3 Installation manual.

.4 Operations manual.

.5 Maintenance manual.

.6 Each manual shall describe in a clear, concise manner the operation characteristics of all system components.

1.4 OPERATION AND MAINTENANCE DATA

.1 Provide data for incorporation into Maintenance Manual specified in Section 26 00 10.

.2 Operation and Maintenance Manual to include:

.1 Operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance.

.2 Technical data illustrated parts lists with parts lists with parts catalogue numbers.

.3 Copy of approved shop drawings.

1.5 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 26 00 10.

.2 Include:

.1 Ten spare plastic break rods for manual pullstations.

1.6 MAINTENANCE

.1 Provide one year's free maintenance with one inspections by manufacturers representative under warranty prior to the first year of service. Submit Inspection Report to The city and Contract Administrator.

1.7 WARRANTY

.1 The system shall carry a one-year warranty from date of acceptance by The city.

1.8 ON-SITE INSTRUCTION

.1 The Fire Alarm System supplier shall provide on-site instruction classes for four 4-hour sessions (total of 16 hours) to familiarize personnel with the operational techniques and procedures for the system.

.2 Provide manufacturer produced video instruction of complete systems operation in generic video format.

1.9 SYSTEM DESCRIPTION

.1 The system shall include equipment, wiring devices, etc., to integrate the fire alarm.

.2 The system components include microprocessor based fire alarm control panels (FACP), peripheral user detection and alarm devices.

.3 The system shall be capable of interconnecting to the card access system to release doors upon activation of fire alarm system., as described herein.

1.10 SYSTEM OPERATION

.1 Fire Alarm System

.1 The actuation of any manual station, flow switch, or automatic detector shall cause all fire alarm signal devices in the building to automatically go into a general alarm state, sounding the signal devices at 120 SPM. The fire alarm signals shall sound for a minimum of one minute before they can be manually silenced by operating the signal in on another zone, the alarm signals shall resound to indicate another alarm.

.2 Any alarm shall cause the following control functions to be activated automatically:

.1 Cause the signal devices throughout the building to sound alarm.

.2 Cause all air moving fans in the building to shut down.

.3 Cause all magnetic door hold-open devices to release.

.4 Cause the security system to de-activate any magnetic locks.

.5 Cause the elevators to be sequentially re-called to street level.

.6 Cause an alarm to be transmitted to the Fire Department via an independent central station.

.3 In the vault area, the sprinkler system is a pre-action zone. Actuation of any smoke detector in this room shall trigger a general alarm state as described above, with the following sequence for the pre-action valve:

.1 Actuation of two (2) or more smoke detectors in the vault on the same level shall initiate the pre-action solenoid valve and flood the system.

.2 Actuation of two (2) or more detectors on independent levels will not trigger the pre-action valve.

.3 Triggering a pull-station in the vault area will immediate trip the solenoid valve and flood the system.

.4 The system shall be capable of providing the following summary print-outs via manual keyboard request:

.1 Alarm summary – prints all points that are in alarm.

.2 Control summary – prints all activated (on) control points.

.3 System summary – prints status of all system points.

.4 Trouble summary – prints status of any supervisory problem within the system.

.5 Time summary – prints system time.

.6 Cancel – prints all programmed control functions in EPROM and RAM in memories.

Part 2 Products

2.1 FIRE ALARM CONTROL PANELS (FACP)

.1 The main FACP Central Console shall contain a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: addressable smoke and thermal detectors, addressable modules, control circuits, and notification appliance circuits, local and remote operator terminals, printers, annunciators, and other system controlled devices.

.2 Operator Control

.1 Acknowledge Switch:

.1 Activation of the control panel acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and trouble LEDs from flashing mode to steady ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the LCD display to the next alarm or trouble condition. In addition, the FACP shall support Block Acknowledge to allow multiple trouble conditions to be acknowledged with a single depression of this switch.

.2 Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.

.2 Signal Silence Switch:

.1 Depression of the Signal Silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition. The selection of notification circuits and relays that are silence able by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto silence timers.

.3 System Reset Switch:

.1 Depression of the System Reset switch shall cause all electronically latched initiating devices to return to their normal condition. Initiating devices shall report if active. Active notification appliance circuits shall not silence upon Reset. Systems that deactivate and subsequently reactivate notification appliance circuits shall not be considered equal. All programmed Control-By-Event equations shall

be re-evaluated after the reset sequence is complete if the initiating condition has cleared. Non-latching trouble conditions shall not clear and re report upon reset.

.4 Lamp Test:

.1 The Lamp Test switch shall activate all local system LEDs, light each segment of the liquid crystal display and display the panel software revision for service personal.

.5 Scroll Display Keys:

.1 There shall be Scroll Display keys for FIRE ALARM, SECURITY, SUPERVISORY, TROUBLE, and OTHER EVENTS. Depression of the Scroll Display key shall display the next event in the selected queue allowing the operator to view events by type.

.3 System Capacity and General Operation

.1 The control panel or each network noted shall provide, or be capable of supporting the quantity of initiating and signaling devices indicated, plus 50% spare capacity for future expansion.

.2 The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit 640 character liquid crystal display, individual, colour coded system status LEDs, and a QWERTY style alphanumeric keypad for the field programming and control of the fire alarm system. Said LCD shall also support graphic bit maps capable of displaying the company name and logo of either The city or installing company.

.3 The control panel or each network node shall include Form-C alarm, trouble, supervisory and security relays rated at a minimum of 2.0 amps @ 30V DC.

.4 It shall include four Class B programmable Notification Appliance Circuit.

.5 The notification appliance circuits shall be programmable to synchronize with the supplied notification appliance devices.

.6 The system shall include a full featured operator interface control and annunciation panel that shall include a backlit LCD display individual colour coded system status LEDs and an alphanumeric keypad with easy touch rubber keys for the field programming and control of the fire alarm system.

.7 The system shall be programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory IC’s to facilitate programming changes.

.4 The FACP or each network node shall provide the following features:

.1 Smoke Detector Sensitivity Test: The system shall provide an automatic smoke detector test function that meets the requirements of CAN/ULC-S527.

.2 Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.

.3 Sensitivity levels for alarm, selected by detector. The alarm level range shall be .5 to 2.35 percent per foot for photoelectric detectors.

.4 The ability to display or print system reports.

.5 Periodic detector test, conducted automatically by the software.

.6 Self optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its prealarm level to just above normal peaks.

.7 Cross zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.

.8 Walk test, with a check for two detectors set to same address.

.9 Day/night automatic adjustment of detector sensitivity.

.10 Device blink control for sleeping areas.

.11 The FACP shall be capable of coding main panel node notification circuits in March Time (120 PPM), Temporal (NFPA 72 A-2-2.2.2), and California Code. Panel notification circuits (NAC 1,2,3 and 4) shall also support Two-Stage operation, Canadian Dual Stage (3 minutes) and Canadian Dual Stage (5 minutes). Two stage operation shall allow 20 Pulses Per Minute (PPM) on alarm and 120 PPM after 5 minutes or when a second device activates. Canadian Dual stage is the same as Two-Stage except will only switch to second stage by activation of Drill Switch 3 or 5 minute timer.

.12 Network Communication

.13 The FACP shall be capable of communicating on a Local Area Network (LAN).

.5 Central Microprocessor

.1 The microprocessor shall be a state-of-the-art, high speed, 16-bit RISC device and it shall communicate with, monitor and control all external interfaces. It shall include an EPROM for system program storage, Flash memory for building-specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure.

.2 The microprocessor shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Control-by-event equations shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.

.3 The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.

.4 A special program check function shall be provided to detect common operator errors.

.5 An auto-program (self-learn) function shall be provided to quickly install initial functions and make the system operational.

.6 Data Communication Loop (DCL)

.1 Each FACP or FACP network node shall support quantity of loops required for system devices as indicated on the drawings. Each DCL interface shall provide power to and communicate with intelligent detectors (photoelectric or thermal) and intelligent modules (monitor or control). Each DCL shall be capable of Class A or B wiring.

.2 CPU shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, prealarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

.7 Serial Interfaces

.1 The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting ULC Listed Information Technology Equipment (ITE) peripherals.

.2 One EIA-232 interface shall be used to connect an ULC-Listed 40 or 80 column printer. Printers that are not ULC-Listed are not considered acceptable substitutes.

.3 The system shall include an EIA-485 port for the serial connection of annunciators and remote LCD displays.

.8 Enclosures:

.1 The control panel shall be housed in a ULC-listed cabinet suitable for [surface] [semi-flush] mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.

.2 The back box and door shall be constructed of steel with provisions for electrical conduit connections into the sides and top.

.3 The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators. For convenience, the door may be site configured for either right or left hand hinging.

.9 Power Supply:

.1 A switching power supply shall be available for the fire alarm control panel or network node and provide power for the control panel and peripheral devices.

.2 Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.

.3 Positive-Temperature-Coefficient (PTC) thermistors, circuit breakers, or other over-current protection shall be provided on all power outputs. The power supply shall provide an integral battery charger for use with batteries up to 55 AH or may be used with an external battery and charger system. Battery arrangement may be configured in the field.

.4 The power supply shall continuously monitor all field wires for earth ground conditions, and shall have the following LED indicators:

Ground Fault LED

AC Power Fail LED

NAC on LED (4)

.5 The main power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.

.6 The main power supply shall provide a battery charger using dual-rate charging techniques for fast battery recharge and be capable of charging batteries up to 200 AH.

.7 All circuits shall be power-limited, per ULC requirements.

.10 Auxiliary Field Power Supply - Addressable

.1 The auxiliary addressable power supply is a remote 24 VDC power supply used to power Notification Devices and field devices that require regulated 24VDC power. The power supply shall also include and charge backup batteries.

.2 The addressable power supply for the fire alarm system shall provide up a minimum of 6.0 amps of 24 volt DC regulated power for Notification Appliance Circuit (NAC) power or 5 amps of 24 volt DC general power. The power supply shall have an additional .5 amp of 24 VDC auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge 7.0 - 25.0 amp hour batteries.

.3 The addressable power supply shall provide four individually addressable Notification Appliance Circuits that may be configured as two Class "A" and two Class "B" or four Class "B" only circuits. All circuits shall be power-limited per ULC requirements.

.4 The addressable power supply shall provide built-in synchronization for certain Notification Appliances on each circuit without the need for additional synchronization modules. The power supply's output circuits shall be individually selected for synchronization. A single addressable power supply shall be capable of supporting both synchronized and non-synchronized Notification Devices at the same time.

.5 The addressable power supply shall operate on 120VAC, 60 Hz.

.6 The interface to the power supply from the Fire Alarm Control Panel (FACP) shall be via the Signaling Line Circuit (DCL) or other multiplexed means Power supplies that do not use an intelligent interface are not suitable substitutes.

.7 The addressable power supply shall supervise for battery charging failure, AC power loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACP via the DCL.

.8 The addressable power supply shall have an option for Trouble Reporting and this option shall be selectable.

.9 The addressable power supply mounts in either the FACP backbox or it's own dedicated surface mounted backbox with cover.

.10 Each of the power supply's four output circuits shall be selected for Notification Appliance Circuit or General Purpose 24 VDC power. Any output circuit shall be able to provide up to 2.5 amps of 24 VDC power.

.11 The addressable power supply's output circuits shall be individually supervised when they are selected to be either a Notification Appliance Circuit when wired Class "A" or by the use of and end-of-line resistor. When the power supply's output circuit is selected as General 24VDC power, the circuit shall be individually supervised when an end-of-line relay is used.

.12 When selected for Notification Appliance Circuits, the output circuits shall be individually selectable for Steady, March Time, Dual Stage or Temporal.

.13 When selected as a Notification Appliance Circuit, the output circuits of the addressable power supply shall have the option to be coded by the use of a universal zone coder.

.14 The addressable power supply shall interface and synchronize with other power supplies of the same type.

.15 An individual or multiple interfaced addressable power supplies shall have the option to use an external charger for battery charging. Interfaced power supplies shall have the option to share backup battery power.

2.2 REMOTE ANNUNCIATORS

.1 Each annunciator shall provide up to 64 alarm and 65 trouble indications using a long life programmable colour LED's. Up to 64 control switches shall also be available for the control of Fire Alarm Control Panel functions. The annunciator will also have an "ONLINE" LED, local piezo sounder, local acknowledge and lamp test switch, and custom zone/function identification labels.

.2 The annunciator may be field configured to operate as a "Fan Control Annunciator". When configured as "Fan Control," the annunciator may be used to manually control fan or damper operation and can be set to override automatic commands to all fans/dampers programmed to the annunciator.

.3 Annunciator switches may be programmed for System control such as, Global Acknowledge, Global Signal Silence, Global System Reset, and on/off control of any control point in the system.

.4 An optional module shall be available to utilize annunciator points to drive EIA485 driven relays. This shall extend the system point capacity by 2,048 remote contacts.

.5 The LED annunciator shall offer an interface to a graphic style annunciator and provide each of the features listed above.

2.3 ADDRESSABLE INITIATING DEVICES

.1 General

.1 Each sensor base shall contain an LED that will flash each time it is scanned by the Control Unit. In alarm condition, the sensor base LED shall be on steady.

.2 Addressable initiating devices shall be complete with separate bases for ease of device replacement due to maintenance.

.3 Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; but shall indicate a "Wrong Device" trouble condition.

.4 The sensor's electronics shall be immune from nuisance alarms caused by EMI and RFI.

.5 Sensors include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the Fire Alarm Control Panel. Sensor address shall be located in base to eliminate false addressing when replacing sensors.

.6 Removal of the sensor head for cleaning shall not require the setting of addresses.

.2 Manual Stations

.1 Addressable 2-stage, red LEXAN, with molded, raised-letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units.

.2 Where required, as indicated on the drawings, provide a tamperproof, clear LEXAN shield and red frame that easily fit over manual pull stations. When shield is lifted to gain access to the station, a battery powered piercing warning horn shall be activated. The horn shall be silenced by lowering and realigning the shield. The horn shall provide 85dB at 10 feet and shall be powered by a 9 VDC battery.

.3 Where required, manual stations shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist. Provides a more easily operated manual station lever compared to standard stations.

.4 Surface mounted manual stations shall be supplied with a factory surface mounted back box.

.3 Thermal Detectors

.1 Thermal detectors shall be supplied with a white finish.

.2 Combination fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; 57-deg C (135-deg F) fixed-temperature setting except as indicated.

.3 Fixed temperature sensing shall be independent of rate-of-rise sensing and programmable to operate at 57-deg C (135-deg F) or 68-deg C (155-deg F). Sensor rate-of-rise temperature detection shall be selectable at the FACP for either 8.3-deg C (15-deg F) or 11.1-deg C (20-deg F) per minute.

.4 High temperature detectors shall be rated to 195-deg F fixed temperature.

.4 Smoke Detectors

.1 Shall be photoelectric or combination photoelectric/heat type as indicated on the drawings.

.2 Shall be complete with a built-in LED alarm indicating light and a white finish.

.3 Shall not require resetting or readjustment after actuation to restore normal operation.

.4 Shall be complete with a twist-locking plug-in base.

.5 Addressable Carbon Monoxide (CO) Detectors

.1 CO detectors shall be ULC listed to CSA 6.19-01 and contain a trouble relay connected to the FACP to indicate end-of-life of the detector.

.2 Detector shall be supplied with a sounder base which provides local annunciation upon activation of the device.

.6 Duct Mounted Smoke Detectors

.1 Photoelectric type with sampling tube of design and dimensions recommended by the manufacturer for the specific duct size and installation conditions where applied.

.2 Detector housing shall contain a minimum of 2 sets of Form ‘C’ contacts.

.3 Duct Housing shall provide a relay control trouble indicator Yellow LED.

.4 Duct Housing shall be a transparent cover to monitor for the presence of smoke.

.5 Duct Housing shall provide two (2) test ports for measuring airflow and for testing.

.6 Duct Housing shall provide a magnetic test area and red sensor status LED.

.7 For maintenance purposes, it shall be possible to clean the duct sampling tubes by accessing them through the duct housing front cover.

.8 Provide remote indicating light for all detectors mounted in concealed spaces.

2.4 SIGNALING DEVICES

.1 Wall and Ceiling Mounted Horn

.1 Shall be listed to CAN/ULC S525

.2 Shall be field programmable with minimum three (3) audibility options and capable of output in a temporal pattern.

.3 Produce a sound level of at least 90dBA measured 10 feet from the device.

.4 Shall mount into a standard 4x4x1 ½" back-box or 4-inch octagon back box.

.5 Shall be wall or ceiling mounted such that the device is flush with the finished wall or ceiling. Extension rings are not acceptable.

.6 Device shall be provided with a white finish to be confirmed by the Consultant prior to ordering.

.2 Wall and Ceiling Mounted Horn/Strobe Combination

.1 Shall be listed to CAN/ULC S525 and S526.

.2 Strobe lights shall meet the requirements of CAN/ULC S524 and be fully synchronized.

.3 Shall be field programmable with minimum three (3) audibility options and capable of output in a temporal pattern.

.4 Produce a sound level of at least 90dBA measured 10 feet from the device.

.5 The strobe light shall consist of a xenon flash rube and associated lens/reflector system.

.6 Strobe lights shall have field-selectable candela settings including: 15, 30, 75, 110 and 135cd.

.7 Shall mount into a standard 4x4x1 ½" back-box or 4-inch octagon back box.

.8 Shall be wall or ceiling mounted such that the device is flush with the finished wall or ceiling. Extension rings are not acceptable.

.9 Device shall be provided with a white finish to be confirmed by the Consultant prior to ordering.

.3 Wall and Ceiling Mounted Strobe

.1 Strobe lights shall meet the requirements of CAN/ULC-524, Installation of Fire Alarm, and be fully synchronized.

.2 Shall consists of a xenon flash tube and associated lens/reflector system, is listed to CAN/ULC-S526 and shall be approved for fire protective service.

.3 Strobe intensity shall meet the requirements of CAN/ULC-S526, Visual Signal Appliances, Fire Alarm.

.4 The flash rate shall meet the requirements of CAN/ULC-S526, Visual Signal Appliances, Fire Alarm.

.5 Shall have field-selectable candela settings including 15, 30, 75, 110 and 135.

.6 Shall mounted into a standard 4x4x1 ½" back-box or 4-inch octagon back box.

.7 Shall be wall or ceiling mounted such that the device is flush with the finished wall or ceiling. Extension rings are not acceptable.

.8 Device shall be provided with a white finish to be confirmed by the Consultant prior to ordering.

2.5 ADDRESSABLE MONITORING AND CONTROL MODULES

.1 Remote Addressable Monitor Modules (RMM)

.1 Monitor water flow, valve tamper, non-addressable detectors or zones etc.

.2 Remote Addressable Relay Monitor Modules (RRM)

.1 Used for control fans, dampers, door holders, magnetic locks, etc.

.3 RMM's and RRM's shall be capable of communicating the zone's status to the FACP through typical detector loops.

2.6 ADDITIONAL DEVICES

.1 Remote Alarm Indicating Lights

.1 Shall be provided for all non-visible smoke detectors installed in concealed spaces, including duct-type smoke detectors.

.2 Shall be LED type mounted on a white faceplate and include a lamacoid nameplate indicating the device connected to the indicating light.

.3 Indicating lights shall be installed in ceiling and be visible from the ground below the finished ceiling.

.2 End-of-Line Resistors

.1 Class A Loop: Resistor shall be mounted with the Fire Alarm Control Panel.

.2 Class B Loop: Resistor shall be mounted in a separate single gang recessed box complete with a white cover plate.

.3 Isolator Module

.1 Isolator modules shall be provided to automatically isolate wire to wire short circuits on a DCL Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the DCL loop segment or branch. At least one

isolator module shall be provided for each floor or protected zone of the building.

.2 If a wire to wire short occurs, the isolator module shall automatically open circuit (disconnect) the DCL. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.

.3 The isolator module shall not require address setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.

.4 The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

2.7 WIRING

.1 The fire alarm system wiring shall be installed in a separate and independent conduit system. All equipment wiring shall be in accordance with the manufacturer's specifications and connections shall be made strictly as shown in the manufacturer's installation instruction.

.2 Manual stations, automatic detectors, bells, sprinklers, flow switches, etc., shall be wired and connected to their respective zone monitor point terminals in the FACP's with #14 AWG conductors (R90) or multi-conductor #18 power limited fire protective 105°C (221°F) cable. Each zone shall end with an E.O.L. resistor as shown on drawings. The zoning and circuiting of the devices shall be as shown on the drawings.

.3 Magnetic door hold open devices (120V AC) supplied and installed by Division 8, shall be wired and connected by Division 26, to their respective control point terminals in FACP with #14 AWG (R90) conductors.

.4 Smoke detectors shall be mounted within 1.5m of door being controlled by magnetic hold open devices/sentronic door closers.

.5 Fire smoke dampers actuator controls shall be wired and connected by Division 26. Provide one (1) fire alarm relay module at each damper by Division 28. Activation of smoke detectors at each damper shall intiate closure of smoke damper actuator as per CAN/ULC-S524. All smoke detectors at fire/smoke dampers shall be installed to the requirements of CAN/ULC-S524 and the Manitoba Building Code.

.6 All control wiring for fan shutdowns, damper controls, etc., shall be wired with #14 AWG (R90) conductors.

.7 The 2/C #18 twisted shielded cables shall be Columbia #C0417 105°C (221°F) or approved equal.

.8 Remote alarm indicating light (RAIL's) for smoke detectors shall be wired and connected with 2/c #18 power limited fire protective 105°C (221°F) cable installed in conduit.

.9 Fire detectors shall be mounted a minimum of 900 mm from an air supply outlet or 500 mm from an air exhaust outlet.

.10 Fire alarm wiring shall not be T tapped.

.11 Fire alarm raceway shall be red EMT pipe or shall have a red marking with in 1' of each junction box and every 5' of pipe.

.12 All junction box covers shall have red marking.

2.8 ZONING

.1 Fire alarm and supervisory zoning to be as per the schedules as shown on drawings.

2.9 MANUFACTURERS

.1 Approved as equal are the following manufacturers provided that all the requirements of this specification are met:

.1 Simplex/Johnson Controls

.2 Edwards/Troy fire and life safety

.3 Notifier/Vipond

.4 Mircom/Fire tech

.2 The manufacturers shall ensure that the requirements of this specification are met before submitting their tenders.

Part 3 Execution

3.1 GENERAL

.1 Locate, install, wire and connect all components and devices in accordance with the requirements of the manufacturer and ULC S524.

3.2 MOUNTING OF EQUIPMENT

.1 Mount equipment at heights as described in Section 26 00 10.

.2 Mount equipment square and plumb with building lines. Install devices flush and square with finished surfaces.

3.3 TERMINATION OF CONDUCTORS

.1 Terminate conductors directly to the terminals of each device. Splices at pigtail types of connections are not permitted.

3.4 IDENTIFICATION

.1 Identify equipment as per Section 26 00 10.

.2 Clearly identify zone on control panels, FACP's, devices, etc.

.3 Identify wires and cables with wire markers to indicate box circuit numbers and terminals, signal circuit numbers and terminals, annunciator wiring. Identify wiring in each box, panel, cabinet, etc. Coding of identification to meet with the approval of the Consultant.

3.5 MISCELLANEOUS DEVICES

.1 Interconnect magnetic door holders, magnetic locks and automatic door operator controls with FACP to release on activation of 'Alarm' condition.

.2 Wire and connect supervisory valves.

.3 Wire and connect to Fire Department Interface. Monitor alarm, trouble, supervisory/trouble and supervisory CO detection

.4 Provide fire alarm demarcation enclosure complete with 16-wire terminal block and associated wiring between FACP and security monitoring panel. Enclosure shall be located in same room as FACP as per CAN/ULC-S524;5.15.

.5 Wire and connect to elevator controller.

.6 Wire and connect fan shut down interlocks.

.7 Wire and connect smoke damper operators and proving switches.

.8 Provide two (2) dedicated telephone lines and 120V power connection to Security Panel.

3.6 TESTING

.1 Conduct tests as per Section 26 00 10.

.2 The complete system shall be tested and verified in accordance with CAN/ULC-S537, "Standard for the Verification of Fire Alarm System Installations". The Manufacturer shall conduct all testing and provide necessary technical personnel. The Electrical Subcontractor to provide necessary manpower to facilitate testing.

.3 The Manufacturer shall conduct an overall examination of the system installation of the following:

.1 The type of equipment installed is that designated by the Consultant's specifications.

.2 The wiring connections to all equipment components show that the installer has observed ULC and CSA requirements.

.3 Equipment has been installed in accordance with the Manufacturer's recommendations and that all signalling devices are operable.

.4 The supervisory components are operating and that regulations governing such supervisory wiring have been met to the satisfaction of the inspecting authorities.

.4 The complete system shall be tested in the presence of the Contract Administrator and The city's Representative on completion of the verification. Tests shall demonstrate that the fire alarm system will function in an acceptable manner. The

Electrical Inspector shall be the final authority in determining the acceptable manner of operation.

.5 Include all costs for setting up and testing the fire alarm system as directed by the Consultant.

3.7 VERIFICATION CERTIFICATE

.1 On completion of the testing, submit to the Consultant, a test report certified by both the Manufacturer and Electrical Subcontractor including:

.1 A copy of the Inspecting Technician's report showing location of each device and certifying the test results of each device.

.2 A Certificate of Verification confirming that the inspection has been completed and showing the conditions upon which such inspection and certification have been rendered.

3.8 OPERATION MAUNUAL SUBMISSION

.1 Contractor shall submit a digital copy of full fire alarm system program on remote USB memory stick with O&M manual submission.

END OF SECTION

Part 1 GENERAL

1.1 TESTING AND INSPECTION

.1 Test topsoil from source prior to stripping and stockpiling, for NPK, Mg, soluble salt content, and pH value.

.2 Submit two (2) copies of soil analysis and recommendations for corrections to Contract Administrator.

.3 Upon completion of finish grading, notify Contract Administrator to allow for inspection. Correct grading as directed.

Part 2 PRODUCTS

2.1 TOPSOIL

.1 Imported topsoil: fertile, friable loam, neither heavy clay nor very light sandy nature, containing minimum 4% organic matter for clay loams and 2% for sandy loams to maximum 25%, free from subsoil, roots, grass, weeds, stones, or foreign objects. Acidity range (pH) of 5.5 to 7.5. Topsoil containing crabgrass, couch grass or other noxious weeds is not acceptable.

.2 Fertilizer: complete commercial synthetic slow release fertilizer with maximum 35% water-soluble nitrogen. Formulation ratio: as recommended by topsoil analysis.

Part 3 EXECUTION

3.1 PREPARATION

.1 Fine grade sub-grade, eliminate uneven areas and low spots. Remove debris, roots, branches, stones in excess of 50mm (2”) diameter and building materials. Remove subsoil that has been contaminated with oil, gasoline or other toxins.

.2 Notify Contract Administrator immediately if large areas of contamination are encountered.

.3 Cultivate entire areas, which are to receive topsoil, to a depth of 100mm (4”).

3.2 SPREADING OF TOPSOIL

.1 Prior to spreading topsoil, notify Contract Administrator and allow for review of sub-grade.

.2 Spread topsoil with adequate moisture in uniform layers during dry weather over approved, dry, unfrozen sub-grade, where sodding and planting is indicated.

.3 Bring topsoil up to finish grade.

.4 Apply topsoil to the following minimum depths: 100mm (4”) for sodded areas.

.5 Remove stones, roots, grass, weeds, construction materials, debris and foreign non-organic objects from topsoil.

.6 Manually spread topsoil around trees and plants.

3.3 APPLICATION OF FERTILIZER

.1 Apply fertilizer at least one (1) week after lime application and at least six (6) days before sodding.

.2 Spread fertilizer with mechanical spreaders over entire area of topsoil at rate determined on basis of soil sample tests.

.3 Mix fertilizer thoroughly into upper 50mm (2”) of topsoil.

3.4 FINISH GRADING

.1 Fine grade entire topsoiled area to contours and elevations as indicated. Eliminate rough spots and low areas to ensure positive drainage.

.2 Roll topsoil with 50kg roller, minimum 900mm (3ft) wide, to compact and retain surface.

.3 Leave surface smooth, uniform, firm against deep foot printing, with a fine loose texture.

3.5 SURPLUS MATERIAL

.1 Dispose of surplus materials not required or not suitable for fill, grading, or landscaping, from the site.

END OF SECTION

Part 1 GENERAL

1.1 PROTECTION

.1 Protect fencing, trees, landscaping, benchmarks, existing roads, sidewalks, paving and curbs, and surface or underground utility lines, which are to remain, against damage. Make good any damage.

.2 Notify Contract Administrator of any unexpected sub-surface conditions. Discontinue Work in area until Contract Administrator provides notice.

1.2 EXAMINATION

.1 Set out all required lines and levels.

.2 Maintain benchmarks, monuments and other reference points. Re-establish if disturbed or destroyed, at no cost to The City.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Clean, washed, coarse bank or river sand, free from clay, shale and organic matter.

.2 Pit run granular material.

.3 Selected native material, acceptable to the Contract Administrator, unfrozen, and free from rocks larger than 75mm (3"), construction debris, organics and other unsuitable materials.

.4 Grading materials may be excavated pervious material, free from roots, building debris, soluble materials and rocks larger than 150 mm (6") in diameter.

Part 3 EXECUTION

3.1 EXCAVATION

.1 Excavate sub-grade to elevations and dimensions required for installation, construction and inspection of Work specified.

.2 Excavate to well defined lines to minimize quantity of fill material required.

.3 Earth bottoms of excavations to be dry, undisturbed soil, level, and free from loose or organic matter.

.4 Remove concrete, masonry, paving, walks, demolished foundations, rubble and other obstructions encountered in course of excavation.

.5 Dispose of surplus and unsuitable excavated material off site.

3.2 BACKFILLING

.1 Backfill around new Work as required.

.2 Slope grades away from building to meet existing grades.

.3 All backfill to be properly leveled and compacted.

.4 Leave site clean and free of debris.

3.3 SURPLUS MATERIALS

.1 Dispose of surplus materials not required or not suitable for fill, grading, or landscaping from site.

END OF SECTION

Part 1 General

1.1 MEASUREMENT PROCEDURES

.1 Provide Lump sum price for the foundation work in accordance with the structural drawings. Indicate quantity of piles to be sleeved that are included in lump sum price. Indicate additional cost per sleeved pile exceeding sleeve allowance.

.2 Provide Lump sum price as a separate line item for the underpinning piles identified on the structural drawings as pile 'P4'.

.3 Friction Piles:

.1 Provide Lump sum price for the foundation work in accordance with the structural drawings.

.4 Caissons:

.1 The Contractor shall provide a fixed lump sum price for the caissons. The price shall include but not be limited to the following: shaft enlargement where belling is not possible, tremied concrete where required, steel sleeves where required, variable till depth, boulder removal where required and any additional means necessary to install the caissons to support the required design capacity.

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA)

.1 CSA-A23.1/A23.2 – Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete

.2 CAN/CSA-G30.18 – Carbon Steel Bars for Concrete Reinforcement

.3 CAN/CSA-S16 – Limit States Design of Steel Structures

1.3 EXISTING CONDITIONS

.1 Sub-surface investigation report has been included as part of this specification. Contractor is to review the report and become familiar with the subsurface conditions.

.2 Notify Contract Administrator in writing if subsurface conditions at site differ from those indicated and await further instructions from Geotechnical Engineer.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Shop Drawings:

.1 Indicate: size of pile, reinforcing steel and ties.

.3 Caissons installation:

.1 Provide caisson installation sequence for review by Contract Administrator at least two (2) weeks in advance of caisson installation.

Part 2 Products

2.1 MATERIALS

.1 Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.2 Reinforcing steel: to CAN/CSA-G30.18 and in accordance with Section 03 20 00 - Concrete Reinforcing.

.3 Steel casing: As required and designed by installer.

.4 Grout: in accordance with Section 03 30 00 - Cast-in-Place Concrete.

2.2 SOURCE QUALITY CONTROL

.1 Mill report to CAN/CSA-S16.

.2 Concrete tests: to CSA-A23.1/A23.2.

Part 3 Execution

3.1 INSTALLATION

.1 Friction piles:

.1 Bore holes to diameters and lengths as indicated. The tips of the piles should not penetrate the glacial till.

.2 Install within 50mm of exact centres set out, 2% of vertical plumb and 25mm of required elevation. Correction of deviations beyond those defined to be at the discretion of Contract Administrator, costs for correction are to be borne by Contractor.

.3 Remove loose material, foreign matter and water as directed by geotechnical engineer.

.4 Vibrate top 4500mm of each pile.

.2 Caissons:

.1 Bore holes to diameters as indicated until required bearing stratum as determined by Geotechnical Engineer is reached.

.2 Construct bell, unless a straight shaft caisson is required.

.3 Bottom of hole shall be hand cleaned.

.4 Geotechnical Engineer to inspect bottom of bore holes prior to placing of concrete. Remove loose material, foreign matter and water as directed by Geotechnical Engineer.

.5 The caisson must be completed on the day that it is started and the concrete shall be placed as soon as possible after the excavation is completed and the base inspected to minimize the risk of base heave.

.6 Schedule caisson work in consultation with the Geotechnical Engineer. Adjacent caissons shall not be excavated simultaneously to minimize the risk of base heave.

.3 Protective steel casing:

.1 Install casing as required. Cost of casing shall be included in lump sum for foundation work.

.4 Remove stones up to 300mm in dimension, boulders over 300mm and rock in whole or in part before boring tool is deflected. If required, lower boring tool and clean hole to ensure that machine auger has reached the required depth.

.5 Check each caisson shaft for toxic and explosive gases and provide appropriate protective measures for personnel working in shaft.

.6 Dispose of excavated materials off site.

.7 Install steel reinforcement in accordance with Section 03 20 00 - Concrete Reinforcing and as indicated.

.8 Fill pile excavations with concrete to elevations as indicated.

.1 Place concrete in one continuous pour in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.9 Steel protective casing may be removed at option of Contractor.

.10 Where steel protective casing is to be removed, provide concrete with minimum slump of 125mm and with retarder to prevent arching or setting of concrete.

.1 Withdraw casing in conjunction with concrete placing, keeping bottom of casing below level of concrete.

.11 Where steel protective casing is left in place, fill void space between casing and shaft excavation with concrete.

.12 Use tremie pipe or concrete pumping as required. Costs of tremied concrete shall be included in the lump sum for the foundation work.

3.2 PROTECTION

.1 If superimposed work is to be placed later, protect top of each unit with at least 150mm of damp sand.

3.3 DEFECTIVE PILES

.1 Cased concrete shaft piles rejected where:

- .1 Soil has entered casing.
- .2 Water has entered casing.
- .3 Casing is damaged, out of tolerance or alignment.

.2 Defective Friction Piles:

- .1 Leave rejected pile in place, place adjacent pile and modify pile cap as directed in writing by Contract Administrator.
- .2 No extra compensation will be made for additional piles and other costs due to installation of damaged or defective piles.

.3 Defective Caissons:

- .1 Perform remedial work as directed by Contract Administrator and Geotechnical Engineer.

3.4 SAFETY

.1 Conform to the latest regulations of the Provincial Building Protection Act and Provincial Building Code and provide all necessary safety equipment required.

3.5 FIELD QUALITY CONTROL

.1 Independent review of friction piling and caisson operations shall be done by an independent inspection and testing agency under cash allowance and retained by The City.

.2 Maintain accurate records for each caisson and pile installation, including:

- .1 Pile size and length, location of pile.
- .2 Location.
- .3 Top of Caisson Elevation.
- .4 Bearing Condition.
- .5 Bearing Capacity.
- .6 Presence of Water.
- .7 Other pertinent information.

.3 Provide Contract Administrator with three (3) copies of records.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 00 – Cleaning and Waste Management.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM)

.1 ASTM Standard D242/D242M – Standard Specification for Mineral Filler for Bituminous Paving Mixtures

.2 ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort

.3 ASTM D946/D946M – Standard Specification for Penetration-Graded Asphalt Cement for use in Pavement Construction

.4 ASTM D995 – Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures

.5 ASTM D2170/D2170M – Standard Test Method for Kinematic Viscosity of Asphalts (Bitumens)

1.2 DESCRIPTION

.1 Excavation for, and preparation and placing of sub-grade, sub-base and base course for asphaltic concrete topping.

.2 Preparation of hot-mixed, hot-laid, asphaltic concrete paving mix, and all placing operations relating to the construction of asphaltic concrete.

.3 Disposal of unused materials.

1.3 PROTECTION

.1 Protect and maintain benchmarks and other reference points, and existing and new building, landscaping, sidewalks, roads, and curbs against damage.

.2 Notify Contract Administrator of any unexpected sub-surface conditions. Discontinue Work in area until Contract Administrator provides notice.

.3 Provide access to building at all times. Arrange paving schedule so as not to interfere with normal use of premises.

.4 Keep vehicular traffic off paved areas until Work is completed. Erect and maintain adequate barricades as required.

1.4 PREPARATION AND LAYOUT

.1 Establish extent of excavation by area and elevation.

.2 Set out all required lines and levels.

1.5 HANDLING AND STORAGE

.1 All materials shall be handled and stored carefully and where designated by the General Contractor.

1.6 INSPECTION AND TESTING

.1 Inspection and testing shall be performed by a qualified geotechnical agency, acceptable to the Contract Administrator, and paid for by cash allowance, refer to Section 01 21 00, Allowances.

.2 Methods of sampling and testing shall be in accordance with the requirements of ASTM D946, and ASTM D2170.

.3 Provide free access to all portions of the Work and cooperate with the inspection agency. Notify agency minimum 48 hours prior to required inspection.

.4 The final sub-grade shall be inspected for suitability and compaction. Areas of unsuitable native material shall be removed and replaced as directed by the Contract Administrator.

.5 The frequency and number of quality control tests shall be as follows:

- .1 Proctor testing on all materials
- .2 Sub-grade inspection: one (1) visit/exposed area
- .3 Field density tests: one (1) test/400m^2/material (i.e.: sub-grade, sub-base, base, and topping)
- .4 Asphaltic concrete pavement: one (1) sample per days production

.6 Submit three (3) copies of the test results to the Contract Administrator.

.7 If, in the opinion of the Contract Administrator, such materials, in whole or in part, do not conform to the specification detailed herein, or are found to be defective in manufacture or have become damaged in transit, storage or handling operations, then such material shall be rejected by the Contract Administrator and replaced by the Contractor at his own expense.

.8 The costs of any re-testing and inspection due to faulty materials or workmanship shall be paid for by the Contractor at no expense to the City. Remedial Work shall be tested as above.

.9 The Cash Allowance for inspection and testing is based on the Paving Work being carried out in a single phase. Additional inspections required to suit the Work being completed as separate installations, will be the Contractor's responsibility.

1.7 EQUIPMENT

.1 All equipment shall be of a type acceptable to the Contract Administrator and shall be maintained in good working order.

1.8 MIXING PLANT

.1 The asphaltic concrete paving mix shall be supplied from an acceptable mixing plant. The mixing plant shall conform to the requirements of ASTM D995.

1.9 COMPACTION DENSITIES

.1 Compaction densities are percentages of maximum densities obtainable from ASTM D698.

Part 2 PRODUCTS

2.1 SUB-GRADE MATERIALS

.1 Selected native material, acceptable to the Contract Administrator, unfrozen, and free from rocks larger than 75mm (3"), construction debris, organics and other unsuitable materials.

.2 Clay fill, unfrozen, and free from rocks larger than 75mm (3"), construction debris, silt, organics and other unsuitable materials.

.3 Select 75 mm (3") down, pit-run gravel, free from shale, friable and organic materials, as acceptable to the Contract Administrator.

2.2 SUB-BASE MATERIAL

.1 "WCA 2": crushed, pit-run or screened stone or gravel, consisting of hard durable particles, free from shale, clay lumps, cementation, organic material, frozen and other deleterious materials, conforming to the following grading requirements:

Sieve Size (Tyler)	% Passing
75mm passing (3")	100
4.76mm (No. 4)	40 – 80
0.074mm (No. 200)	5 – 20

2.3 BASE COURSE MATERIAL

.1 "WCA 1": crushed, pit-run or screened stone or gravel, consisting of hard durable particles, free from shale, clay lumps, cementation, organic material, frozen and other deleterious materials, conforming to the following grading requirements:

Sieve Size (Tyler)	% Passing
25.4mm passing (1")	100
12.7mm (1/2")	70 – 90
4.76mm (No. 4)	40 – 75
2.00mm (No. 10)	20 – 55
0.42mm (No. 40)	10 – 35
0.074mm (No. 200)	5 – 15

.2 Material passing the 0.42mm (0.02") sieve shall have a liquid limit not greater than 25 and a plasticity index of one (1) to six (6).

.3 Not less than 35% of the material retained on the 4.76mm (0.2") sieve shall consist of crushed particles.

2.4 LIME OR PORTLAND CEMENT

.1 Lime or type 10 normal Portland cement may be used for drying the sub-grade, upon receiving acceptance from the Contract Administrator. Lime shall meet CSA A82.43 and Portland cement shall meet CAN/CSA-A5.

2.5 ASPHALTIC CONCRETE CONSTITUENT MATERIALS

.1 Aggregates: Contractor shall furnish in writing to the Contract Administrator, the location of the sources where aggregate will be obtained, to allow inspection by the Contract Administrator. Changes in the source of aggregate supply during the course of the Contract shall not be permitted without notification and acceptance of the Contract Administrator.

.2 Fine aggregate: sand having clean, hard, strong, durable, uncoated grains, free from injurious amounts of dust, soft or flaking particles, shale, alkali, organic matter, loam or other deleterious substances.

.3 Coarse aggregate: natural gravel, crushed stone or other approved materials of similar characteristics having clean, hard, strong, durable, uncoated particles, free from injurious amounts of soft, friable, thin elongated or laminated pieces, alkali, organic or other deleterious matter.

.4 Crushed stone: angular, cubical fragments of aggregate of uniform quality throughout. It shall be produced from rock formations or from boulders and stones shall be from sources of approved nature and origin. Coarse aggregate shall not be accepted from rock formations or from boulders and stones containing intrusions or stratifications of an undesirable nature or other source showing signs of disintegration from the elements or other causes.

.5 Asphalt cement: prepared by the refining of crude petroleum by suitable methods. The asphalt cement shall be homogenous, free from water and shall not foam when heated to 175°C (347°F).

.6 Mineral filler: when required shall consist of finely divided mineral matter such as rock dust, slag dust, hydrated lime, hydraulic cement fly ash, loose or other suitable mineral matter, and shall conform to the requirements of ASTM D242.

.7 The mineral aggregate shall be combined to produce a uniformly graded mixture, which meets the following grading requirements:

Sieve Size (Tyler)	**% Passing**
19.1mm passing (3/4")	100
15.9mm (5/8")	95 – 100
9.53mm (3/8")	70 – 90
4.76mm (No. 4)	50 – 70
2.00mm (No. 10)	35 – 55
0.42mm (No. 40)	15 – 30
0.074mm (No. 200)	4 – 8

.8 The combined aggregate gradation limits and physical requirements of the asphaltic concrete shall be in accordance with the current City of Winnipeg specifications.

.9 Coarse aggregate shall conform to the following requirements:

.1 Crushed aggregate – aggregate retained on the 4.76mm (0.2") sieve shall contain not less than forty percent (40%) crushed aggregate

.2 Shale content – aggregate retained on the 4.76mm (0.2") sieve shall contain not more than three percent (3%) shale particles

.10 The design of the asphaltic concrete paving mix shall be by the Marshall method, the number of compaction blows on each face of the test specimens shall be 75. The asphaltic concrete paving mix shall conform to the following physical requirements:

.1 Asphalt content (%): 5.0 to 6.0

.2 Marshall stability (lbs): 1200 minimum

.3 Flow index (0.01"): 8 to 15

.4 Air voids (%): 2.0 to 5.0

.5 Voids in mineral aggregate (%): 15.0 minimum

2.6 PRIME COAT

.1 Prime coat shall consist of either emulsified or cutback asphalt. Selections shall be based upon existing field conditions and shall be subject to the acceptance of the Contract Administrator. Apply only as required and conforming to manufacturer's recommendations.

2.7 TACK COAT

.1 Tack coat shall consist of either emulsified or cutback asphalt. Selection shall be based upon existing field conditions and shall be subject to the approval of the Contract Administrator. Method of application shall conform to manufacturer's recommendations.

2.8 GEOTEXTILE FABRIC

.1 Woven Geotextile fabric, standard of acceptance: Armtec #855, with the following properties:

.1 Grab tensile strength: 1340 N to ASTM D4632.

.2 Grab tensile elongation: 15% to ASTM D4632.

.3 Wide width tensile: 31 kN/m to ASTM D4595.

.4 Wide width elongation: 15/15% to ASTM D4595.

.5 Mullen burst: 4134 kPa to ASTM D3786.

.6 Puncture: 530 N to ASTM D4833.

.7 Trapezoid tear: 530N to ASTM D4533.

.8 UV resistance: 70% @ 500 h to ASTM D4355.

.9 Apparent opening size: 0.425mm to ASTM D4751.

.10 Permittivity: 0.02 sec. to ASTM D4491.

.11 Flow rate: 1.4 to ASTM D4491.

Part 3 EXECUTION

3.1 SUB-GRADE PREPARATION

.1 Inspect areas to receive paving and ensure all suitable organic topsoil has been removed.

.2 Remove all loose, organic, soft material subject to decay, or otherwise unsuitable material, to expose the natural sub-grade level.

.3 Excavate to the paving sub-grade level where the underside of the paving section is lower than the natural sub-grade level.

.4 Stockpile suitable material required for fill, as directed by the Contractor. Remove material not for reuse from the site.

.5 Proof-roll the prepared sub-grade with a heavy sheep's-foot roller (minimum 20 passes).

.6 Contact inspection agency to inspect the sub-grade. Notify the Contract Administrator of any unusual sub-surface conditions, which may prevent satisfactory performance of the Work.

.7 Compact exposed sub-grade to 95% standard Proctor maximum dry density.

.8 Provide additional sub-grade material as required to build-up to the underside of the sub-base course (i.e.: when the natural sub-grade level is lower than the pavement sub-grade level).

.9 Sub-grade material shall be compacted in maximum 150mm (6") layers at the optimum moisture content or at moisture content up to 2% above the optimum moisture content.

.10 Compact additional sub-grade material to 95% standard Proctor maximum dry density, in maximum 150mm (6") layers.

.11 If excess water occurs to cause local or continuous ponding, soil compaction shall not be permitted until sufficient soil drying has occurred.

.12 Lime or Portland cement may be used to dry out the sub-grade, if acceptable to the City. Review with Contract Administrator prior to proceeding.

.13 Notify the testing agency to perform compaction tests. Repair soft spots as required.

3.2 GEOTEXTILE

.1 Install geotextile fabric on prepared sub-grade, and up sides of excavation, minimum 200mm (8"). Lap 600mm (2'-0") minimum. Install in strict accordance with manufacturer's specifications.

3.3 SUB-BASE

.1 Place granular sub-base to compacted thickness scheduled.

.2 Sub-base material shall be placed in maximum 150mm (6") layers, compacted to 100% standard Proctor maximum dry density, for the full width of the excavation.

.3 Notify the testing agency to perform compaction tests of the completed sub-base. Repair soft spots as required before the base material is placed.

.4 The final compacted layer of sub-base shall be trimmed to the elevation of the bottom of base course.

3.4 BASE COURSE

.1 Place granular base to compacted thickness scheduled.

.2 Base course material shall be placed in maximum 150mm (6") layers, compacted thickness, for the full width of the excavation. The base course shall be thoroughly compacted to a minimum of 100% standard Proctor maximum dry density.

.3 The compacted base course shall be trimmed to the finished base course elevation as indicated on the drawings. The finished base course shall be maintained in a smooth compacted condition until the topping is placed.

.4 Notify the testing agency to perform compaction tests of the finished base course. Repair soft spots as required, before the topping is placed.

3.5 TACK COAT

.1 Tack coat the existing concrete pavement only when dry, clean and when weather conditions are suitable.

3.6 ASPHALT TOPPING

.1 No topping course shall be started until any frost or moisture from previous inclement weather has evaporated to leave a dry surface. The surface course shall be laid only under such conditions that the Contract Administrator determines to be conducive to obtaining the specified results.

.2 Apply primer where required, at least 24 hours prior to asphalt surfacing.

.3 The mixture shall be delivered to the job and placed at a temperature optimum for proper compaction, taking into consideration the weather conditions, the temperature of the surface on which the mixture is to be placed, and the thickness of the lift. In no case shall the mixture be placed at a temperature of less than 125°C, nor greater than 155°C. Unless otherwise permitted by the Contract Administrator, the mixture shall be spread by means of mechanical self-powered paver capable of spreading the mixture true to the line, grade and crown required. Provide as continuous an operation as possible.

.4 Before placing mixture against longitudinal joints, curbs, gutters, headers, manholes, etc., all contact surfaces shall be painted with a thin, uniform coating of hot asphalt cement or MC-O cut back asphalt. Well-bonded and sealed joints are required in all cases. Joints between old and new pavements shall be made by cutting the edge of the previously laid course the full depth so as to expose a fresh surface after which the hot mixture shall be placed in contact with it, and raked to proper depth and grade.

.5 When laying asphalt against a curb, gutter or adjoining pavement, and after the hot mixture has been laid by mechanical paver, just enough of the mixture shall be carried back to fill any voids. The work of “setting up” this joint shall be performed by competent workmen, who are capable of making a correct, clean and neat joint.

.6 Place compacted asphaltic concrete in thickness indicated, smooth, true to grade, within tolerance of 6mm in 3m (0.25” in 10’-0”).

.7 Compact each course with roller, when it can support roller weight without undue cracking or displacement.

.8 Roll until roller marks are eliminated. Compact to 96% Marshall density to ASTM 01559.

.9 Compact mixture with hot tampers in areas inaccessible to roller.

.10 Allow compaction tests on the finished paving. Repair areas not meeting the specifications, as required, and to match adjacent surfaces.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A53/A53M – Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

.2 ASTM F668 – Poly (Vinyl Chloride) (PVC) and Other Organic Polymer-Coated Steel Chain-Link Fence Fabric

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-138.1 – Fabric for Chain Link Fence

.2 CAN/CGSB-138.2 – Steel Framework for Chain Link Fence

.3 CAN/CGSB-138.3 – Installation of Chain Link Fence

.4 CAN/CGSB-138.4 – Gates for Chain Link Fence

.5 CAN/CGSB-1.181 – Ready-Mixed Organic Zinc-Rich Coating

.3 Canadian Standards Association (CSA)

.1 CAN/CSA-G164 – Hot Dip Galvanizing of Irregularly Shaped Articles

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00, Submittal Procedures.

.2 Provide shop drawings clearly indicating overall layout, post locations and spacing, bracing, gates, material thickness, fasteners and connections.

Part 2 PRODUCTS

2.1 FENCE COMPONENTS

.1 Fabric: chain link to CAN/CGSB-138.1, hot dipped galvanized after weaving to CAN/CSA-G164, average 488g/m^2 (1.6 oz of zinc/ ft^2) of surface area minimum, number 9 gauge steel wire, woven in a 50mm (2") mesh. Height as indicated.

.2 Gate frames: hot dipped galvanized pipe, standard weight, 43mm (1-11/16") O.D. for outside frame, 35mm (1-3/8") O.D. for interior bracing.

.1 Electrically weld at all joints, and hot-dip galvanize.

.2 Fasten fence fabric to gate with twisted selvage at top.

.3 Tie wire and post clips: for attachment of wire fabric to rails, hot dip galvanized or aluminum wire.

.4 Organic zinc rich coating: to CAN/CGSB-1.181.

.5 Fittings and hardware: cast aluminum alloy, galvanized steel or malleable or ductile cast iron of mouldings of sufficient strength to ensure the integrity of the fence. Post caps to provide waterproof fit, to fasten securely over posts and to carry top rail. Turnbuckles to be drop forged.

2.2 FINISHES

.1 Galvanizing (posts and rails):

.1 Pipe: 550g/m^2 minimum to ASTM A90/A90M

.2 Other fittings: to CAN/CSA-G164

.2 Vinyl coated (mesh): chain link fabric (mesh) shall be vinyl coated to ASTM F668. Colour: to be selected.

Part 3 EXECUTION

3.1 INSTALLATION OF GATES

.1 Install gates at bin enclosure as indicated on AS-7.1.

.2 Level contours between gate posts and set gate bottom approximately 150mm (6”) above finished grade surface as detailed.

3.2 TOUCH UP

.1 Repair damaged galvanized surfaces. Clean damaged surfaces with a wire brush, removing loose and cracked coatings. Apply two (2) coats of organic zinc-rich paint to damaged areas. Pre-treat damaged surfaces according to manufacturer’s instructions for zinc-rich paint.

.2 Repair damaged vinyl coated surfaces as required, in accordance to manufacturer’s recommendations.

END OF SECTION

Part 1 GENERAL

1.1 DELIVERY AND STORAGE

.1 Deliveries shall be scheduled in order to keep storage at job site to a minimum without causing delays.

.2 Sod shall be delivered, unloaded and stored on pallets.

.3 Sod shall be delivered to the site within 24 hours of being lifted, and laid within 36 hours of being lifted.

.4 During wet weather, sod shall be allowed to dry sufficiently to prevent tearing during lifting and handling. During dry weather, the sod shall be protected from drying and shall be watered as necessary to ensure its vitality and to prevent dropping of soil in handling. Dry sod and small, broken or irregular pieces of sod will be rejected.

1.2 SCHEDULING

.1 Laying of sod shall be scheduled to coincide with topsoil operations.

1.3 WARRANTY

.1 The Contractor shall agree and guarantee to replace any lawn found dead and/or in poor condition one year from recognized completion date, at no cost to the City. Exempted is lawn damaged by accidental causes, wear and poor maintenance practice by the City, as substantiated in written form over the course of the warranty period.

Part 2 MATERIALS

2.1 SOD

.1 Nursery Sod: Number One Grade Kentucky Bluegrass Sod to contain not less than 50% Kentucky Bluegrass cultivars. Other grasses and clovers should not be apparent in the turf and no more than two (2) broadleaf weeds or ten (10) other weeds per 40m^2 shall be present. Sod shall be sufficient density that no surface soil will be visible when mowed to a height of 40mm (1.6”). The mowing limit shall be 35mm to 65mm (1.4” to 2.6”), and the thickness of the soil portion of the sod shall not exceed 15mm (0.6”). All sod shall be mineral based sod.

2.2 MATERIALS

.1 Water shall be potable.

.2 Fertilizer shall be a completely synthetic slow release fertilizer with maximum thirty-five percent (35%) water-soluble nitrogen.

Part 3 EXECUTION

3.1 WORKMANSHIP

.1 The site shall be kept well drained.

.2 Any soil or debris spilled onto streets or walks shall be cleaned up immediately, and any deleterious materials shall be disposed of.

3.2 LAYING SOD

.1 Obtain acceptance of topsoil grade and depth prior to sodding.

.2 Sodding shall be done during the growing season. Sodding during a dry summer season, at freezing temperatures or over frozen soil, is not acceptable.

.3 Lay sod in rows, perpendicular to slope, smooth and even with adjoining areas, and with joints staggered. Sections shall be butted closely without overlapping or gaps between sections. Irregular or thin sections shall be cut out using a sharp knife.

.4 Sod shall be rolled with a light roller to provide close contact between the soil and sod. Heavy rolling to correct irregularities in grade is not permitted.

.5 Sod shall be watered immediately after laying to obtain moisture penetration through sod into top 100mm (4”) of topsoil.

.6 Adequate protection of sodded areas, against erosion and mechanical damage, shall be provided, and be removed after the lawn areas have been accepted.

3.3 TOP DRESSING

.1 Top dressing shall be done only if deemed necessary by the Contract Administrator.

.2 If required, top dressing shall be dry, friable and clean topsoil having high humus content, spread to a thickness of 5mm to 10mm (0.2” to 0.4”) over low and bare spots.

.3 If required, top seeding shall be as specified by the Contract Administrator. Topsoil and seed shall be mixed by means of heavy raking, rolled with a light roller and watered, ensuring contact between topsoil, seed and top dressing.

3.4 MAINTENANCE

.1 Sodded areas shall be maintained from the start of Work until a full two (2) weeks after the recognized completion date.

.2 Sod shall be watered in sufficient quantities and at required frequency to maintain the sub-soil immediately under the sod continuously moist for a depth of 75mm (3”).

.3 Grass shall be cut for the first time to 40mm (1.6”) when it reaches a height of 60mm (2.4”). Clippings, which will smother the grassed areas, shall be removed.

.4 No fertilizer is required for the first fall if a pre-sodding fertilizer has been applied. Otherwise an application of 245grams of nitrogen per 100m^2 shall be applied one (1) month after sodding. Fertilizer shall be applied when the grass is dry, then watered immediately. Fertilizing shall be postponed until the next spring if the application falls within the four (4) week period prior to the expected end of the growing season.

.5 It shall be the responsibility of the Contractor to ensure that the City is familiar with the standard practice of maintenance and is prepared to continue the maintenance from the completion date. If at any time during the warranty period, the Contractor considers the City is not providing the proper maintenance, the Contractor shall notify the Contract Administrator in writing.

3.5 ACCEPTANCE

.1 Sodded area will be accepted at the final inspection provided that:

- .1 Sodded areas are properly established
- .2 The sod is free of bare and dead spots and without weeds
- .3 No surface soil is visible when the grass has been cut to a height of 40mm (1.6”)
- .4 Sodded areas have been cut a minimum of two (2) times

.2 Lawns sodded in the fall will be accepted in the following spring, one (1) month after the start of the growing season provided the acceptance conditions are fulfilled.

END OF SECTION

APPENDIX A

GEOTECHNICAL REPORT

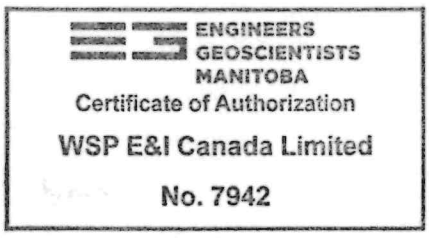
NO. CA0022965.9019
26 MARCH 2024

GEOTECHNICAL REPORT

CITY ARCHIVES BUILDING EXPANSION DEVELOPMENT
380 WILLIAM STREET, WINNIPEG, MANITOBA

REPORT INFORMATION:			
Report Name:	Geotechnical Report City Archives Building Expansion Development 380 William Street, Winnipeg, Manitoba WSP Project Number – WX17307		
Prepared for:	City of Winnipeg c/o MCM Architects Inc. 300 – 275 Carlton Street, Winnipeg, Manitoba R3C 5R6		
Contact:	Daniel Long, Architect | MAA, MRAIC, LEED® AP | Associate		
REPORT DISTRIBUTION:			
MCM Architects	Daniel Long, Architect | MAA, MRAIC, LEED® AP | Associate		
Third Party:	Crosier Kilgour Attn: Tyler Smeall, CIM, P.Eng. | Principal		
Report Classification:	Confidential		
	Name	Job Title	Signature
Prepared by:	Kelly Johnson, P. Eng.	Principal Geotechnical Engineer	
Reviewed by:			
Project Manager:	Kelly Johnson, P. Eng.	Principal Geotechnical Engineer	
Other Technical Contributors			

Rev.	Date	Revision Notes
0	26 March 2024	Submitted for Use

Permit Stamp	Engineer Seal
	

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23 February 2024

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City of Winnipeg
c/o MCM Architects
300 – 275 Carlton Street Winnipeg, Manitoba R3C 5R6

Attention: **Daniel Long, Architect | MAA, MRAIC, LEED® AP | Associate**

Subject: **City Archives Building Expansion Development**
380 William Street, Winnipeg, Manitoba

WSP is pleased to submit this Geotechnical Report for the proposed City Archives Building Expansion development to be located at 380 William Street in Winnipeg, Manitoba. If you have any questions, please contact the undersigned directly at 204-770-2149 (c).

Yours sincerely,

Kelly Johnson, P.Eng.
Principal Geotechnical Engineer
Geotechnical Engineering, Prairies and North

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1 INTRODUCTION

At the request Daniel Long of MCM Architects Inc. (MCM), working with Crosier Kilgour & Partners Ltd. (CKP), WSP Canada Inc (WSP), formerly AMEC Environment & Infrastructure), this geotechnical report comprises an update to the 2014 Geotechnical Report completed for upgrades to 380 William by WSP's predecessor company, AMEC Earth & Infrastructure, a division of AMEC Americas Limited (AMEC). The 2014 Geotechnical Report needed to be updated with a seismic site classification, and references to 2015 National Building Code needed to be reviewed and updated for conformance with National Building Code of Canada 2020.

This report provides background information on the 2014 Geotechnical Investigation and summarizes subsurface conditions encountered at the test hole locations in 2014, and presents geotechnical engineering recommendations for: seismic site classification, pile foundation alternatives; frost design considerations; structurally supported main floor and underlying crawlspace; grade supported garage slab, asphalt pavement sections; temporary excavation and backfill considerations; final site grading, surface drainage and subdrainage; and foundation concrete.

2 BACKGROUND INFORMATION

2.1 SITE AND PROJECT DESCRIPTION

The City of Winnipeg Archives Building is located at 380 William Street in Winnipeg, Manitoba (latitude 49.900321°, longitude -97.145114°). Based on information provided to WSP by CKP, it was understood that the existing building is more than 100 years old and was originally supported by footings. In the 1940s and 1950s, the building foundations were underpinned with end bearing belled caissons with approximately 760 mm (30 in) shaft diameters and 1.5 m (5 ft) bell diameters. Per review of as-built information contained within the 1948 Piling Plan (Drawing 1551, May 1948), belled caissons along the southern half of the west wall along which the addition will be constructed reportedly bear on till at about 11.0 m to 11.3 m below the underside of the basement footings.

Redevelopment of the property began in 2014, for which WSP's predecessor, AMEC Earth & Infrastructure, a division of AMEC Americas Limited (AMEC), previously completed a geotechnical investigation and issued a draft geotechnical investigation report, AMEC file #WX17307, dated 27 January 2014 (the Draft Report). The purpose of the geotechnical investigation was to verify the subsurface soil and groundwater conditions at the site in order to provide geotechnical recommendations for design and construction of a proposed new shipping and receiving addition and a major renovation of the existing building. The scope of work for the project was outlined in WSP's proposal number WPG2013.201 R1, dated 2 December 2013.

At the time of the geotechnical investigation, it was understood that the proposed redevelopment consisted of the following:

- Development of a new shipping & receiving addition at the southwest side of the existing building, with a base floor level about 1.5 m (5 ft) below existing grade (2014) and a second-floor slab 3.1 m (10 ft) above the base floor level.

- A major building renovation incorporating a Climate Controlled Archival Vault and its associated operational, programming and office facilities, and possibility of a new structural basement floor slab development for the existing building.

It is understood that only portions of the project proceeded to construction, and that an update to the 2014 geotechnical report to meet current 2020 National Building Code of Canada (NBCC 2020) is required. This geotechnical report comprises said update, as well Updates to the 2014 Geotechnical Draft Report contained in this report were made in consideration of the following main elements of the proposed redevelopment, as conveyed by MCM.

- Development of a new four-level climate and humidity-controlled vault space for storage of archive collections complete with associated spaces for staging, isolation, digitization and other conservation activities;
- Development of new spaces for research, public access programming, administrative offices and support;
- Development of a new shipping and receiving area in the southwest corner of the existing building complete with a loading dock and materials lift/elevator from 4 feet above grade to basement level including cast-in-place elevator pit with oil separator;
- Replacement of approximately 50% of existing basement slab on grade floors with a reinforced structural slab designed to support projected storage loads; and,
- Reinforcement of existing main floor, second floor and mezzanine floors to support projected storage loads including new cast-in-place piles, structural steel beams and columns tied into existing floor framing and masonry walls.

2.2 2014 GEOTECHNICAL INVESTIGATION

Prior to initiating drilling, WSP notified public utility providers (i.e. Manitoba Hydro, MTS, City of Winnipeg, etc.) of the intent to drill in order to clear public utilities, and where required, met with said representatives on-site.

On 9 December 2013, WSP supervised the drilling of one test hole (TH01) at the approximate location illustrated in Figure 1. The test hole was drilled using a truck mounted B40 drill rig equipped with 125 mm diameter solid stem augers; operated by Maple Leaf Drilling Ltd. of Winnipeg, Manitoba.

During drilling, WSP field personnel visually classified the soil stratigraphy within the test hole in accordance with the Modified Unified Soil Classification System (MUSCS); as well as noted any observed seepage and/or sloughing conditions. Grab samples were collected at selected depths and retained in sealed plastic bags for shipping, review, and select testing in WSP's Winnipeg laboratory. Shelby tube samples were also collected at selected depths for possible laboratory testing. The in-situ relative consistency of cohesive overburden was evaluated within the test hole using pocket penetrometer readings. The recorded pocket penetrometer readings are shown on the test hole log. The relative consistency of the underlying till was evaluated using a standard penetration test (SPT), where the number of blows to drive the SPT sampler 0.3 m into the soil was recorded. The recorded number of blows is shown on the test hole log as the SPT (N) value.

Upon completion of drilling, the depth to slough and groundwater level within the test hole was obtained after an elapsed time of about 10 minutes. Subsequently, the test hole was backfilled to the underside of the gravel pavement structure with bentonite and auger cuttings, followed by reclaimed gravel fill to the underside of existing asphalt pavement, and finally, to grade with compacted cold patch asphalt. Excess auger cuttings were removed from site.

Following completion of the field drilling program, a laboratory testing program was conducted on selected soil samples obtained from the test hole. The laboratory testing program completed consisted of moisture content determinations, three unconfined compressive strength tests, and one set of liquid limit and plastic limit determinations.

A detailed test hole log summarizing the sampling, field testing, laboratory test results, and subsurface conditions encountered at the test hole location is presented in Appendix A. Actual depths noted on the test hole log may vary by ± 0.3 m from those recorded due to the method by which the soil cuttings are returned to the surface. Summaries of the terms and symbols used on the test hole log and of the Modified Unified Soil Classification System are also presented in Appendix A.

3 SUBSURFACE CONDITIONS

With the possible exception of near surface site grading works (i.e. within 2.0 m of existing grade), subsurface conditions at the test hole locations are anticipated to remain consistent with the findings of the 2014 Geotechnical Investigation. If soil conditions different than those summarized here-in are encountered during subsequent stages of the project (i.e. construction), WSP should be notified for review and possible revision of the geotechnical recommendations outlined in this report.

4.1 STRATIGRAPHY

Consistent with the regional geology and anticipated conditions, the stratigraphy at the test hole location consisted of the following, in descending order from grade level:

- Asphalt and Gravel Fill
- Clay
- Silt (Low Plastic Clay)
- Clay
- Silt (Till)

A brief description of each of the soil layers bulleted above is presented below: For detailed descriptions, the test hole log in Appendix A should be consulted.

3.1.1 ASPHALT AND GRAVEL FILL

Asphalt pavement was encountered at the surface of TH01 and extended to about 50 mm below grade. The asphalt was underlain by about 100 mm of frozen, poorly graded, medium-grained granular fill. Assessment of the parking lot condition was not possible due to snow and ice cover.

3.1.2 CLAY

Clay was encountered beneath the gravel pavement structure and extended to about 1.2 m below surface. The clay was silty with some gravel likely originating as inclusions from the overlying pavement structure, high plastic, dark grey, and frozen. In-situ moisture contents of about 28 percent and 29 percent were obtained on thawed samples.

3.1.3 SILT

Shallow silt, or low plastic clay (CL) commonly referred to in Winnipeg as silt, was encountered between 1.2 m and 2.1 m below grade. The silt was generally described as clayey, low plastic, very moist to wet, soft to firm, and brown. A single in-situ moisture content of about 24 percent was obtained near the top of the silt layer. Atterberg Limits testing on a sample of the silt indicated a liquid limit of about 30 percent, and a plastic limit of about 16.

3.1.4 CLAY

Consistent with typical soil conditions in Winnipeg, highly plastic lacustrine clay was encountered beneath the silt layer. The clay was silty, moist, stiff becoming firm below 6.1 m, and brown. In-situ moisture contents within the clay were relatively uniform throughout the depth of the layer and ranged from 43 percent to 54 percent. Unconfined compressive strength tests were completed on three Shelby tube samples collected from TH01; the results of which are summarized in Table 3-1.

Table 3-1: Summary of Unconfined Compressive Strength Tests

Test Hole	Depth (m)	UCS (kPa)	ε100 (%)	Bulk Density (kg/m^3)	Moisture Content (%)
TH01	6.1 – 6.7	66	4.3	1718	54
TH01	9.1 – 9.8	82	4.2	1772	49
TH01	12.2 – 12.8	55	7.9	1799	43

3.1.5 SILT (TILL)

Glacial silt till was encountered beneath the clay in TH01 at about 14.0 m below grade, and extended to the end of the test hole at around 15.7 m depth. The till comprised a low plastic silt matrix containing some clay with a trace of sand and gravel, and was moist and compact near the clay overburden interface becoming damp and very dense with depth. In-situ moisture contents within the till ranged from about 16 percent near the top of the layer to about 9 percent at auger refusal, and indicated a trend of decreasing moisture with penetration into the till. A single SPT 'N' value of 98 blows for 225 mm of penetration (i.e. SPT refusal) was obtained at 15.7 m below grade.

3.2 GROUNDWATER AND SLOUGHING CONDITIONS

Seepage and sloughing conditions were noted during drilling, and the depth to the accumulated water level within the test hole was measured about ten minutes after drilling.

No sloughing conditions were noted during drilling, however slight seepage was observed from the silt layer between 1.2 and 2.1 m depth. While slight squeezing-in or "necking" of the soft clay was noted in TH01

between 9.1 and 10.7 m depth, the hole remained open to full depth until backfilled. The water level within the borehole was measured at 15.4 m below grade.

It should be noted that only short-term seepage and sloughing conditions were observed and that groundwater levels can fluctuate annually, seasonally or as a result of construction activity. For design purposes per the recommendation outlined here-in, a groundwater table of 5 m below existing grade is recommended.

4 GEOTECHNICAL RECOMMENDATIONS

4.1 GENERAL EVALUATION

The stratigraphy and soil conditions encountered within the test hole advanced at the site are considered typical of conditions within Winnipeg, Manitoba and are considered favourable for the proposed development. From a foundations perspective, soil conditions are considered suitable for the use of a variety of pile foundation alternatives including bored straight shaft cast-in-place (CIP) concrete friction piles, belled end-bearing piles, and driven pre-cast pre-stressed concrete piles (PPCPs). Selection of which pile foundation alternative to employ will depend on foundation loads and allocation of construction and performance risks. Advantages and disadvantages of each of the three pile foundation types at this site are summarized in Table 4-1, below. Shallow footings were not requested by CKP and are not recommended by WSP given the susceptibility of local highly plastic soils to change in volume (i.e. shrinkage and swell) due to changes in moisture content and the propensity of these soils to consolidate in the long term under applied loads.

Table 4-1: Advantages and Disadvantages of Pile Foundation Alternatives

Pile Type	Advantages	Disadvantages
Bored Straight Shaft Friction Piles	• Can be bored with minimal vibration imparted to the existing foundations. • Can be installed in tight overhead conditions.	• Lowest load carrying capacity of the pile foundations here-in. • May require sleeving due to potential sloughing and seepage in the silt layer and potential necking of the clay with depth.
Belled End-Bearing Piles	• Largest load carrying capacity of the pile foundations here-in. • The existing structure is underpinned by belled piles which appear to have performed satisfactorily.	• May require sleeving due to potential sloughing and seepage in the silt layer and potential necking of the clay with depth. • Serviceability (settlement) of the pile necessitates a clean, stable

	• Can be bored with minimal vibration imparted to the existing foundations.	base free of slough and softened materials. • Greatest total and differential settlement potential of the pile foundations here-in. • Potential cobbles and boulders within the till could inhibit belling, the removal of which could carry a larger potential for construction 'extras'.
Driven Pre-cast Piles	• Lowest total and differential settlement potential of the pile foundations here-in. • Generates the least amount of soil spoil. • Minimal drilling and no sleeving requirement.	• Pile driving will impart vibration on adjacent structures, and vibration monitoring is recommended. • Pile driving is loud in comparison to boring, and may disturb the nearby school.

With respect to a grade supported concrete floor slab, shallow soil conditions are considered typical of Winnipeg conditions; although shallow silt is likely to necessitate subgrade improvement works (i.e. sub-excavation and replacement with gravel) for a basement slab located 1.5 m below grade. At their current in-situ moisture states, the estimated volumetric swell potential of the upper soils if additional moisture were available may give marginal rise to grade supported slab movements in the range of 20 mm to 40 mm which are considered to be typical of conditions encountered in Winnipeg. If the risk for total and differential slab movement is intolerable, then a structurally supported slab should be used.

The following sections provide discussion and recommendations as they pertain to: driven and bored concrete pile foundation alternatives; lateral earth pressures on below grade walls; frost design considerations; structurally supported and grade supported concrete slabs; asphalt and granular pavement sections; trench excavation and backfill; and foundation concrete.

4.2 SEISMIC SITE CLASSIFICATION

The seismic site classification was determined based on Table 4.1.8.4.-B of the National Building Code of Canada 2020 (NBCC 2020), which categorizes the foundation soil conditions into 6 types – Class 'A' to 'F.' This classification is based on the average shear wave velocity, SPT 'N' values, or undrained shear strength over the top 30 m of the soil profile.

Based on geology and correlation with the thickness and undrained shear strength of the overburden clay deposits, the site is categorized as Seismic Class 'C'. Further information on site designation can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)."

The spectral acceleration values for the site as a function of return period can be obtained from the Online Seismic Hazard Interpolator[1] provided by Natural Resources Canada, which provides seismic values for the design of buildings in Canada under Part 4 of the NBC 2020 as prescribed in Article 1.1.3.1 of Division B of the NBC 2020.

4.3 PILE FOUNDATIONS

4.3.1 AXIAL COMPRESSIVE RESISTANCE SINGLE DRIVEN PRE-CAST PRE-STRESSED CONCRETE (PPC) PILES

Hexagonal pre-cast pre-stressed concrete piles driven to practical refusal in the very dense till under an appropriate hammer energy and force configuration are considered a suitable pile foundation alternative. Based on the depth to auger refusal during drilling, it is anticipated that pre-cast concrete piles could be driven to practical refusal at the site between about 16 m and 18 m below existing grade, although it should be noted that shallower or deeper pile refusal may also occur depending on undulations in dense glacial till surface and variability in the relative density of the till.

The unfactored (ultimate) resistance of a driven pre-cast concrete pile should be limited on the basis of the pile properties and the hammer used to drive the piles. Typically, a minimum hammer energy of 40 kJ per blow is recommended in driving pre-cast pre-stressed concrete piles to practical refusal in Winnipeg. To limit potential structural damage to the piles, the piles should not be driven beyond practical refusal as noted in Table 4-2. The unfactored (ultimate) resistance should be limited based on hexagonal pile diameter as outlined in Table 4-2.

Table 4-2: Single Pile Resistance Limits for Pre-cast Concrete Piles - ULS

Hexagonal Pile Size (mm)	Unfactored Pile Resistance (kN)	Refusal Criteria (blows/25mm)	
		No Follower	With Steel Follower
300	1,200	5	6
350	1,650	8	10
400	2,100	12	15

Based on the *2020 National Building Code of Canada* (NBCC 2020), a geotechnical resistance factor, $\Phi = 0.4$ should be applied to the unfactored geotechnical compressive resistance of the pile to obtain the factored geotechnical resistance at the Ultimate Limit State (ULS) for compressive loading conditions. If a pile testing program is implemented such as Pile Dynamic Analysis (PDA), on a suitable number of production piles (i.e. 3

[1] https://www.seismescanada.rncan.gc.ca/hazard-alea/interpolat/nbc2020-cnb2020-en.php

to 5%) a geotechnical resistance factor of (Φ) of 0.5 could be applicable to those results obtained specifically from the PDA testing as opposed to the estimated values provided in Table 4-2 above.

Additional comments for design and construction of driven pre-cast concrete piles are as follows:

- Pre-cast concrete piles typically require pre-bore pilot holes to facilitate pile installation. Pre-boring to a maximum depth of about 1/3 of the pile length is recommended to promote pile verticality and alignment, and to reduce the effects of pile heave during driving of adjacent piles, which is particularly important in pile groups. The recommended pre-bore depth should be strictly controlled and monitored during construction, as large diameter and deep pre-bores could provide a conduit for upward seepage of groundwater from the underlying till and bedrock. Common to local construction practice, a pre-bore diameter slightly larger than the circumscribed circle of a hexagonal pile is employed. However, where shaft friction is required over the pre-bore depth and/or where lateral support is critical, pre-bore holes should be limited to no larger than 85% of the nominal pile diameter such that the pre-cast piles fit tightly in the drilled holes.
- Static pile design parameters pertain to soil resistance only. The pile cross sections must be designed to withstand the design loads and the driving forces during installation.
- Frost design considerations are outlined in Section 4.5.
- Recommendations for uplift resistance calculations are provided in Section 4.3.3.
- Piles must be spaced a minimum of three pile diameters apart, as measured from centre-to-centre, in order to act individually as single piles in vertical compression when used in a small pile group of three piles or less. Where larger pile groups are required, the pile group should be reviewed by WSP.
- All piles driven within five pile diameters should be monitored for heave and, where heave is observed, piles should be re-driven. Piles that are re-driven should be advanced to at least the original elevation.
- All piles should be driven continuously to practical refusal once driving is initiated.
- Any piles that have been damaged, are excessively out of plumb, or have refused prematurely may need to be replaced, pending a review by a qualified geotechnical engineer of their load carrying capability and estimated settlement.
- All pile caps and grade beams should be underlain by a minimum 150 mm thick void form to accommodate the expansive nature and potential frost heave of the underlying soil.
- Monitoring of the pile installations by qualified personnel is recommended to verify that the piles are installed in accordance with design assumptions and that driving criteria are satisfied.
- Vibration monitoring for potential impact to the existing structure is recommended.

4.3.2 AXIAL COMPRESSIVE RESISTANCE OF SINGLE BORED CONCRETE PILES

Bored concrete piles may be designed solely as friction piles, fully end-bearing piles, or combination shaft friction and end-bearing piles. The recommended unfactored unit shaft friction and unfactored unit end

bearing values presented in Table 4-3 may be used in determining the unfactored compressive resistance of a bored CIP pile.

Table 4-3: Unit Shaft Friction & End Bearing Values for CIP Concrete Piles - ULS

Depth Below Final Grade[1] (m)	Assumed Soil Type	Unfactored Unit Shaft Friction (kPa)	Unfactored Unit End Bearing (kPa)
0 to X	All	0	--
X to 9.5	Firm Clay	37	--
9.5 to 14	Soft Clay	25	225
14 to 16	Very Dense Silt Till	--	2,700

[1] X = 1.5 m below slab/crawlspace grade in heated areas, or the depth of frost penetration in unheated areas, as recommended to account for possible movement of the soil away from the perimeter of the pile.

The end-bearing pressure with the underlying till is contingent on a minimum embedment depth of the base of the pile, measured from grade, being at least 2.75 times the diameter of the bell, or of the pile tip in the case of a straight-shaft pile. In the case of conventionally bored straight shaft and belled concrete piles, the following design procedures should be adopted:

- The end-bearing resistance should be neglected unless the bases of the piles are suitably cleaned of disturbed soil. The methods of cleaning the pile bases, proposed by the selected piling contractor should be approved by a qualified geotechnical engineer.
- If pile shaft capacity is to be included in the design of belled piles, shaft friction should be ignored for the height of the bell and a height of one shaft diameter above the top of the bell.

With respect to belled piles, belled piles should be designed terminating upon dense till approximately 1 m to 2 m below the surface of the till where water bearing silt or sand layers are not highly anticipated. Based on the test hole information, soil conditions within the upper 1 m to 2 m of till are likely suitable to permit belling operations.

Based on the *2020 National Building Code of Canada* (NBCC 2020), a geotechnical resistance factor, $\Phi = 0.4$ should be applied to the unfactored geotechnical compressive resistance of the pile to obtain the factored geotechnical resistance at the Ultimate Limit State (ULS) for compressive loading conditions. The following recommendations also apply to the design of bored cast-in-place concrete piles.

- The weight of the embedded portion of the pile may be neglected in the design.
- The pile embedment depth, pile diameter, steel reinforcement and concrete compressive strength should be determined by the structural engineer, as required, to provide sufficient resistance to the applied loads.
- For conventionally bored straight shaft piles, the minimum pile spacing should be at least 2.5 pile diameters. In the case of belled piles, the recommended minimum edge-to-edge spacing between two adjacent bells should be 1 bell diameter. The excavation of adjacent piles within three (3) pile diameters should be deferred until the concrete in the constructed pile has set.

- Frost design considerations are outlined in Section 4.5.
- Recommendations for uplift resistance calculations are provided in Section 4.3.3.
- A void space (minimum of 150 mm thick) should be constructed, using a compressible and biodegradable material, below all piles caps and to accommodate movements of the underlying soil.

Recommended procedures for the installation of conventionally bored, cast in-place concrete piles are:

- Slight seepage from the silt layer and 'necking' or squeezing of the test hole beyond 9.1 m below grade (i.e. below groundwater table) were noted during drilling. Should sloughing soil conditions and/or water bearing silt or sand layers be encountered during pile installation, steel casing should be installed in the augured excavations to control caving and groundwater seepage so that piles are cast in clean, dry holes. The level of fresh concrete in the casing must be maintained above the caving or seepage zone as the casing is withdrawn, and should be sufficiently high to equilibrate pressures inside and exterior of the casing to prevent collapse or squeezing of the sidewall into the pile bore.
- The bases of end bearing piles must be thoroughly cleaned of all loosened materials and seepage accumulations. Should loosened soil remain on the base after repeated attempts of mechanical cleaning with drilling tools, hand cleaning will be required. Where hand cleaning and down-hole inspection is required, the minimum shaft diameter must be 750 mm in order to accommodate the necessary casing needed to access the bell.
- All piles should be poured immediately after completion of drilling to reduce the potential for seepage and swelling or squeezing of the pile bore, as well as to mitigate stress relief which could negative impact pile settlement performance. Concrete should be poured in accordance with the latest edition of Canadian Standards Association A23.1 (Concrete Materials and Methods of Concrete Construction). Where required, dewatering of pile test holes should be managed using a bailing bucket or a submersible pump subject to actual field conditions.
- It should be recognized that the underlying till consists by nature of a heterogeneous mixture of fine grained and coarse grained soil deposits, and as such, it is possible that occasional cobbles and/or boulders could be encountered in the pile bores. Depending on the size of an encountered boulder, removal of these obstructions may be difficult using conventional auguring techniques, and large drop chisels may be required to break-up these boulders.
- A qualified and experienced inspector should be on site during the entire period of pile installation. The inspector should keep complete and accurate records of the pile installations. For belled piles, the pile inspector should verify that a competent bearing stratum has been attained and that the base of the bell has been adequately cleaned.

4.3.3 TENSILE (UPLIFT) RESISTANCE (SINGLE PILE)

Piles resisting structural uplift loads and single pile structures (such as light poles) will need to be designed to resist tensile loads induced by frost and transient loads. Frost design penetration depths and design considerations are outlined in Section 4.5.

In the case of CIP straight shaft fiction piles and driven PPCPs, the uplift resistance of a single pile will be provided by the sustained downward load on the pile (if applicable) and shaft friction along the length of pile

embedded below the depth of frost penetration. The unfactored (ultimate) uplift resistance of CIP concrete piles due to shaft friction can be determined using the unfactored unit shaft friction values outlined in Table 4-3. Similarly, the unfactored (ultimate) uplift resistance of a driven pre-cast pre-stressed concrete pile due to shaft friction can be determined using the unfactored unit shaft friction values outlined in Table 4-3; however the length of pile over which shaft friction can be included in calculation of uplift resistance will depend on the diameter and depth of the pre-bore employed during construction. Where the pre-bore is larger than the inscribed circle of a hexagonal pile, shaft friction must be neglected over the depth of the pre-bore. Where the pre-bore is equal to or smaller than the inscribed circle of the hexagonal pile, shaft friction may be applied over the length of pile below the depth of frost.

With respect to belled piles, the unfactored (ultimate) soil component of the uplift resistance of a belled pile can be considered as the "pullout" resistance of a cylindrical mass of soil projected above the circumference of the bell. The resistance will include the shear forces in the soil as the pile is lifted, and the combined effective weight of the pile and soil above the bell. For the sustained load condition, the unfactored uplift resistance of a belled pile may be determined by the following:

$$P_{ult} = \frac{\pi}{2}\gamma' BD^2 K \tan\phi + \frac{\pi}{4}\gamma' B^2 D$$

Where:

	P_{ult}	=	Unfactored (ultimate) uplift resistance (kN)
	B	=	Diameter of bell (m)
	D	=	Depth of pile embedment (m)
	γ'	=	Effective unit weight of soil (use γ' = 17 kN/m^3 above the groundwater table and γ' = 7.5 kN/m^3 below the groundwater table; See Section 3.2**Error! Reference source not found.** for recommended groundwater level)
	ϕ	=	Residual angle of internal friction (use ϕ = 12°)
	K	=	Empirical lateral earth pressure coefficient for uplift Calculations (use K = 0.7 in clay overburden)

The first term of the above equation is the soil frictional resistance whereas the second term is the weight of soil and pile.

For the case of short term uplift loads, the unfactored resistance of a belled pile against uplift may be determined by:

$$P_{ult} = \pi C_m BD + \frac{\pi}{4}\gamma' B^2 D$$

With the exception of the Cm term, the remaining terms are similar to those previously defined. Cm is the "mobilized" cohesion and may be taken as the unit shaft friction values and soil zones outlined in Table 4-3.

Based on the *2020 National Building Code of Canada* (NBCC 2020), a geotechnical resistance factor, Φ = 0.3 should be applied to the unfactored geotechnical tensile resistance of the pile to obtain the factored geotechnical resistance at the Ultimate Limit State (ULS) for tensile loading conditions. For driven PPCPs, the depth of prebore will also need to be neglected, unless a prebore diameter as noted in Section 4.3.1 is utilized.

4.3.4 LATERAL RESISTANCE (SINGLE PILE)

Significant horizontal (or lateral) loading conditions requiring evaluation of lateral load resistance of piles is not anticipated. Consequently, recommendations pertaining to the lateral load resistance of piles are not provided here-in.

Where the lateral load capacities or magnitude of movements of piles are critical, it is recommended that the lateral deflections and design capacities of piles or groups of piles be evaluated using Reese's method of p-y curves. This method models the strength-deformation characteristics using load-displacement curves for the various soil strata, and the non-linear behaviour of the soil. With the method of p-y curves, solutions may be obtained through an iterative procedure performed using LPILE Software for single piles, and extended to pile groups by using GROUP Software to analyze the behaviour of piles in a group subjected to both axial and lateral loadings. The analytical procedure provides lateral pile deflections, generated bending moments, shear forces, and the soil reaction computed at close intervals over the depth of the pile. This type of analysis with group action effects could be conducted by WSP on request.

4.3.5 SERVICEABILITY LIMIT STATE AND SINGLE PILE SETTLEMENT

The settlement of a single pile depends on the applied load, strength-deformation properties of the foundation soils, load transfer mechanism, load distribution over the pile embedment depth, and the relative proportions of the load carried by shaft friction and end-bearing. A pile settlement limit value was not specified by the structural agent for use in developing geotechnical resistance limits for the serviceability limit state design criterion. Notwithstanding, assuming good workmanship, inclusive of good excavation, the predicted settlement of piles at *working loads equal to a maximum given by the factored shaft frictional resistance of the pile* are:

- For bored straight-shaft fully friction-type concrete piles where end-bearing is neglected, the predicted settlement of a single pile would be in the range of 0.1 to 0.5 percent of the shaft diameter, plus elastic shortening due to the compressive load acting on the pile.
- For fully end-bearing piles where shaft friction is neglected but soil is still in contact with the shaft of the pile, the predicted settlement of a single pile would be in the range of 0.3 to 1.0 percent of the toe diameter (i.e. shaft diameter in the case of large diameter straight shaft piles, or of the bell diameter in the case of belled piles).
- For combination shaft friction and end-bearing piles, the predicted settlement of a single pile would be in the range of 0.5 percent to 1.5 percent of the toe diameter (i.e. shaft diameter in the case of straight shaft piles, or of the bell diameter in the case of belled piles).
- For pre-stressed pre-cast concrete piles driven to practical refusal into the glacial till, the predicted settlement would be in the range 0.5 to 1 percent of the shaft diameter plus the elastic shortening of the pile due to the compressive load acting on the pile.

4.3.6 PILE GROUP EFFECTS

Generally, piles will behave individually in compression (i.e. Group efficiency □ = 1.0) when a minimum centre-to-centre spacing of 5 pile diameters is provided between adjacent piles, and will behave individually laterally

when the center-to-center spacing is greater than 3 diameters in the direction transverse to loading (side-by-side), and greater than 8 diameters in the direction parallel to loading (in-line). However, for circumstances in which piles are closely spaced and/or the piles are connected by a rigid pile cap forcing equal settlement behaviour at the pile heads, interaction between the piles will occur and should be considered in design.

Notwithstanding the above, WSP does not anticipate that large groups of four or more closely spaced piles will be required. Consequently, recommendations pertaining to the axial and lateral load resistances of pile groups are not provided here-in. If pile groups are required by design, WSP should be notified and a review of possible group interactions effects evaluated.

4.4 LATERAL EARTH PRESSURES ON BELOW GRADE WALLS

4.4.1 SOIL DESIGN PARAMETEERS

Below grade walls (i.e. foundation walls, wall for sumps, and other substructures) will be required to resist lateral pressures from the surrounding soil, water, and any additional surcharge loading (i.e. fill, live surface loads, etc.). Table 4-4 provides recommended design values for the bulk unit weight, angle of internal friction, and 'at rest', active, and lateral earth pressure coefficients for moderately to well compacted native clay and compacted granular fill soils.

Table 4-4: Earth Pressure Coefficients and Soil Unit Weights

Soil Type		Active Pressure Coefficient K_a	"At Rest" Earth Pressure Coefficient K_o	Passive Pressure Coefficient[a] K_p	Total Soil Unit Weight (kN/m^3)	Friction Angle (deg) Between Soil and Concrete
Granular Fill	Well Compacted	0.30	0.40	2.5	23	25
	Moderately Compacted	0.35	0.45	2.2	22	25
Common Clay Fill	Well Compacted	0.53	0.70	1.26	16	12
	Moderately Compacted	0.59	0.75	1.13	15	12

The passive earth pressure coefficients provided in Table 4-4 include a reduction factor of 1.5 to account for the partial mobilization of passive resistance that is consistent with the small wall displacements expected under operational conditions. Relatively large wall displacements would be necessary to realize full passive resistances.

With respect to subsurface drainage and groundwater conditions over the depth of the foundation structure, the phreatic surface within the clay overburden should be taken as 5 m below existing grade. The use of free

draining backfill and the provision of drainage behind vertical subsurface walls is strongly recommended, and will further serve to mitigate frost action on vertical walls extending through the zone of frost penetration.

The magnitude and distribution of the lateral earth pressures on below grade structures will depend on such factors as the rigidity of the below grade structure; the degree of compaction of the backfill against the structure; the backfill soil type; the slope angle at the structure/soil interface; and the subsurface drainage and groundwater conditions over the height of the structure. It is anticipated that a sloped excavation will be implemented for construction of below grade foundation structures, which will necessitate the placement of backfill behind below grade structure walls. The magnitude and distribution of the lateral earth pressures (P) on below grade structures will depend on the degree of compaction of the backfill. In addition to earth pressures, lateral stresses generated by any applicable surcharge loads also need to be evaluated in the design. Recommended earth pressure distributions for light to moderate and moderate to well compacted backfill cases, as well as for line or point surcharge loads, are discussed in Section 4.4.2.

It is recommended that a cap of clay, concrete or asphalt should be placed at the surface adjacent to the foundation walls to reduce the migration of surface water into the underlying granular backfill materials. If a clay cap is used, a minimum thickness of approximately 0.5 m is recommended. Further details on the provision of drainage behind the foundation walls are provided in the section on permanent dewatering.

4.4.2 CALCULATION OF EARTH PRESSURE DISTRIBUTIONS AND LOAD FACTORS

4.4.2.1 MODERATE TO WELL COMPACTED BACKFILL CASE

Where subgrade support on the surface of the retained soil behind a wall is required, the backfill against the wall will need to be compacted to at least 95 percent Standard Proctor maximum dry density. The use of free draining backfill behind below grade structures is strongly recommended in order to maintain drained conditions behind the structure. Assuming drained conditions, the design earth pressure distribution should adopt a combined trapezoidal/triangular distribution as shown on Figure 2 to account for the induced lateral pressures due to compaction. Figure 2 also provides the relationships to be used in the calculation of the compaction induced earth pressures, and tabulated loads (P) generated by typical compactors. The earth pressure coefficients to be used in the calculation of the lateral pressures should be those applicable to the backfill types given in Table 4-4 above.

If sub-drainage is not provided and a perched groundwater level were to develop within the retained soil, the hydrostatic component should be included in addition to the earth pressure given in Figure 2.

4.4.2.2 LIGHT TO MODERATE COMPACTED BACKFILL CASE

For the case of lightly compacted backfill, (i.e. less than 95 percent Standard Proctor maximum dry density), the design lateral earth pressure may be taken as a triangular distribution as illustrated on Figure 3. The use of free draining backfill behind below grade structures is strongly recommended in order to maintain drained conditions behind the structure. Contrarily, the hydrostatic component should be included if sub-drainage is not provided and a perched groundwater level were to develop within the retained soil.

4.4.2.3 SURCHARGE LOADS

In addition to earth pressures, lateral stresses generated by surcharge loads, such as point loads from heavy trucks or fill around the building perimeter, also need to be evaluated in the design. For line or point surcharge loads, the lateral pressures should be determined using the relationships given in Figure 4. In the

case of uniformly distributed surcharge loads, such as those acting on the surface of the retained soil, the induced lateral earth pressure may be determined by multiplying the surcharge load by the appropriate earth pressure coefficient.

4.5 FROST DESIGN CONSIDERATIONS

4.5.1 FROST PENETRATION DEPTH

The upper stratigraphy at the test hole location, and across the site, is considered moderately to highly frost susceptible in the presence of water, and as such, frost effects should be considered for foundations or surface structures sensitive to movement. Based on historical temperature data for the Winnipeg area, a design frost penetration, assuming cohesive soils from ground surface, may be taken as 2.4 m below final grade in unheated areas that will not have regular snow or vegetative ground cover. Where there is beneficial heat loss into the soil from the superstructure and/or foundations, the depth of frost penetration may be taken as 1.5 m along the perimeter of the structure. Alternatively, the depth of frost penetration (and thus frost effects) may potentially be reduced by installing insulation. WSP can provide recommended insulation details for specific development conditions upon request.

4.5.2 PILE FOUNDATIONS

Frost forces applied to pile foundations include adfreeze pressures acting along the pile shafts within the depth of frost penetration. If pile caps are used and extend beyond the perimeter of the underlying pile, then frost heave forces acting on the undersides of the pile caps, as well as any connecting supports (i.e. lateral tie between the piles) will also need to be considered.

4.5.2.1 FROST HEAVE

To reduce the potential of frost heave pressures, a void-forming product should be installed beneath the underside of the pile caps and any other structural element located within the depth of frost penetration. The recommended minimum thickness of the void should be 150 mm. Alternatively, a compressible material may be used in lieu of a void forming material, and the uplift pressures may be taken as the crushing strength of the compressible medium. It is recommended that a frost heave of 150 mm be assumed in determining the required thickness for the void-filler and the associated uplift pressures associated with the thickness used.

The finished grade adjacent to each pile cap or grade beam should be capped with well compacted clay and sloped away so that the surface runoff is not allowed to infiltrate and collect in the void space or in the compressible medium.

4.5.2.2 ADFREEZE STRESSES

Resistance to adfreeze and frost heave forces will be provided by the sustained vertical loads on the foundation, the buoyant weight of the foundation and dead weight of the structure, and the soil uplift resistance component provided by the length of the pile extending below the depth of frost penetration. In the case of straight shaft piles supporting lightly–loaded unheated facilities, the piles should be embedded a minimum of 9 m below final grade in order to provide sufficient frictional resistance against potential adfreeze stresses. For heated structures which allow beneficial heat loss into the soil, minimum pile lengths of 6 m are

recommended. Where piles for heated structures are exposed to unheated conditions during construction, they should be designed for the unheated condition.

In the case of straight shaft piles supporting relatively large sustained loads, the required minimum embedment depth may be reduced depending on the available uplift resistance of the pile. In such cases, the minimum pile embedment depth may be designed using an unfactored adfreeze stress of 65 kPa applied over the recommended frost penetration depth, and the uplift resistance of the pile may be determined using the Tensile (Uplift) Resistance recommendations presented in the preceding sections of this report; as applicable to the pile type being employed.

Adfreeze stresses along the sides of pile caps and buried substructures can be reduced by the installation of a 'bond-break' or 'friction reducer' within the zone of frost penetration. Friction reducers could consist of a system of poly wrapped sono-tubes. A smooth geosynthetic liner material, fixed to the shaft of the pile or to the sides of the pile cap would also be a suitable bond-break.

4.6 GRADE-SUPPORTED CONCRETE SLABS

4.6.1 GENERAL

Based on the test hole information and report from CKP that the new addition will have a base floor level at about 1.5 m (5 ft) below the existing grade, soil conditions following excavation to subgrade design elevation for the basement slab are expected to consist of very moist, soft, low plastic silt. In this regard, where a grade supported slab is elected for the base slab of the addition, subgrade improvement works are expected. With respect to exterior grade supported slabs located near existing grade, soil conditions following excavation of the existing pavement structure to subgrade design elevation are expected to consist of clay within five percent of optimum moisture content.

It should be realized that grade supported slabs are susceptible to differential movements due to non-uniform subgrade support and heave due to freezing of the subgrade in unheated areas. Movements associated with non-uniform subgrade support can be mitigated with proper subgrade preparation and the use of a compacted granular base course layer immediately beneath the slab. Given the structure is likely to be heated, the potential for frost heave beneath the slab, with possible exception at doorways, is considered negligible. The potential occurrence and magnitude of frost heave at doorways will depend on the availability of water and can be reduced in part by providing and maintaining proper surface drainage.

Potentially of greater concern are movements associated with the expansive nature of the clay present at this site. Highly plastic montmorillonite clays, such as those at the site, are highly susceptible to volumetric change with changes in soil moisture (i.e. when moisture content increases, highly plastic montmorillonite clays swell, and when moisture decreases, highly plastic montmorillonite clays shrink). In particular, at their current moisture state, the clay within 1.5 m of existing grade is considered moderately susceptible to swell. The susceptibility to swelling of the shallow silt is low and of the underlying highly plastic clay is low; however, it should be noted that wetting or drying of highly plastic clay during construction can either increase or decrease the shrinkage/swell potential of the subgrade prior to construction of the grade-supported concrete slabs.

The actual occurrence and magnitude of swell will depend on the availability of water and uptake of moisture by the soil. The availability of water can be mitigated in part by providing and maintaining proper surface

drainage; although it should be noted that development of previously vacant sites with buildings tends to change the evapotranspiration balance of the soil often resulting in an increase in soil moisture content. The volumetric swell potential, or magnitude of swell, can be reduced in part with proper subgrade preparation and moisture conditioning of the subgrade prior to construction of the grade supported slab.

Given the conditions encountered, movements of grade supported slabs are likely to be in the range of 20 to 40 mm, which are considered to be typical of that normally encountered within the City of Winnipeg, but may be more under extreme circumstances. Assuming that the risk of such slab movements is acceptable to the owner, then grade-supported concrete slabs can be designed and constructed as recommended herein. If the potential for total and differential slab movement is intolerable, then a structurally supported slab should be used.

4.6.2 SUBGRADE PREPARATION

Movements associated with non-uniform subgrade support and shrinkage/swelling can be mitigated to some degree with proper subgrade preparation and moisture conditioning, as well as the use of a compacted granular layer immediately beneath the grade supported slab. Recommendations for subgrade preparation prior to the placement of gravel base course are outlined herein:

1. Remove from within the slab area all unsuitable materials such as construction or demolition debris, organic soils with greater than 6 percent organic content, and other deleterious material. Depending on design grades, continue to excavate as required until subgrade design elevation is achieved.
2. Stripping and excavation to subgrade design elevation should be completed in such a manner as to minimize disturbance of the subgrade. In this regard, WSP recommends that excavation be completed using a backhoe equipped with a smooth bladed bucket operating from the edge of the excavation. Further, no construction equipment should be allowed on the exposed subgrade until an assessment of the subgrade has been completed by knowledgeable and experienced geotechnical personnel.
3. An assessment of the subgrade shall be completed in order to identify any localized loose, 'weak', or soft areas prior to trafficking the subgrade and/or prior to fill operations. Ground conditions permitting, assessment of the subgrade should consist of proof-rolling the subgrade with multiple passes of a fully loaded tandem. Notwithstanding, the ability of a subgrade to support proof-roll loads is subject to change throughout construction as a result of changing moisture conditions, and in this regard, proof-rolling may not be possible. The exposed subgrade and feasibility of proof-rolling of the subgrade should be visually evaluated by qualified personnel throughout stripping and subgrade preparation operations.
4. Loose, 'weak', or soft areas identified either visually or by proof-rolling should be sub-excavated a minimum of 300 mm below design subgrade or as required to achieve a competent subgrade stratum up to a maximum of 400 mm below grade, and replaced with engineered fill material, as directed by the engineer at the time of construction. If a competent subgrade stratum is not encountered within 400 mm of subgrade design elevation, it is anticipated that soft subgrade conditions could be 'bridged' by the placement of a 400 mm granular bridging layer consisting of 150 mm minus crushed limestone underlain by a geotextile separator, such as Propex 350 ST.

5. Protect the exposed subgrade from frost, desiccation (drying), and inundation (wetting) both during and following construction. To reduce accumulation of surface runoff and softening of the subgrade, rough grades should be designed to minimize ponding of water on the surface and to provide positive drainage towards the perimeter of the subgrade area and/or collection areas as quickly as possible, both during and following subgrade preparation.

6. Depending on disturbance and protection of the subgrade, exposed subgrades that are desiccated or inundated outside of acceptable range of the optimum moisture content (i.e. more than ± 5 percent) should be scarified to a minimum of 200 mm below grade, moisture conditioned to between two percent above and five percent above optimum moisture content, and re-compacted to a minimum of 95 percent of standard Proctor maximum dry density (SPMDD). If excavation to subgrade minimizes disturbance of the subgrade and the subgrade is within an acceptable moisture state, than this step is not required.

4.6.3 INTERIOR FLOOR SLABS

Interior grade-supported concrete slabs should be underlain by a minimum gravel structure thickness of 300 mm consisting of 150 mm of base course underlain by 150 mm of granular subbase. Each of the gravel layers should be compacted to 100 percent of SPMDD at ±3 percent of optimum moisture content. It is recommended that the gravel should meet the gradation requirements outlined in City of Winnipeg Specification CW3110-R14. Other gradations may be suitable but should be reviewed by the geotechnical engineer prior to use.

The clay subgrade is estimated to have a subgrade resilient modulus of about 20 MPa, as correlated to a typical California Bearing Ratio (CBR) of 2 percent under soaked conditions. For the purposes of determining concrete slab thicknesses, grade-supported concrete slabs designed on an approved subgrade prepared as outlined in Section 4.6.2 and the gravel base structure outlined above may be designed assuming a subgrade reaction modulus (k) of 35 MPa/m.

Further to the above, interior floor slabs should be provided with joints or saw cuts at regular intervals to control and reduce random cracking. All partition walls or equipment founded on the slabs should have a minimum 50 mm thick void space at the top to mitigate damage if the slabs should heave. Interior floor slabs should be free floating, and should be structurally separated from the foundation walls, columns, and foundation walls, except possibly at doorways.

4.6.4 GRADE-SUPPORTED SIDEWALKS AND APRON SLABS

With respect to sidewalks and apron slabs, the upper soils at the site are considered moderately to highly frost susceptible given access to free water. Furthermore, the local clay soils are highly susceptible to swelling and shrinkage with associated increase or reduction in soil moisture. As such, it is important that adequate site drainage be provided adjacent to exterior sidewalks and aprons to help reduce the accumulation of infiltration water beneath the slabs that could result in frost heave or soil expansion.

Exterior grade-supported concrete slabs should be underlain by a minimum gravel structure thickness of 300 mm consisting of 150 mm of base course underlain by 150 mm of granular subbase. Each of the gravel layers should be compacted to 100 percent of SPMDD at ±3 percent of optimum moisture content. It is recommended that the gravel should meet the gradation requirements outlined in City of Winnipeg

Specification CW3110-R14. Other gradations may be suitable but should be reviewed by the geotechnical engineer prior to use.

The clay subgrade is estimated to have a subgrade resilient modulus of about 20 MPa, as correlated to a typical California Bearing Ratio (CBR) of 2 percent under soaked conditions. For the purposes of determining concrete slab thicknesses, grade-supported concrete slabs designed on an approved subgrade prepared as outlined in Section 4.6.2 and the gravel base structure outlined above may be designed assuming a subgrade reaction modulus (*k*) of 35 MPa/m.

Due to the potential for frost heaving of exterior slabs, all sidewalks and apron slabs should be structurally separate from the structure, and should not be dowelled into the grade beam or the interior slabs except at doorway locations.

Where it is proposed to dowel exterior slabs into structure components, or where frost related movement of the slab is undesirable, rigid insulation could be placed on the subgrade to reduce the depth of frost penetration beneath the slab. The placement of insulation along the sides of grade beams should be avoided in order to allow heat loss from the building and lessen frost effects. WSP can provide recommended insulation details for specific exterior grade-supported slabs and apron slabs once the design configurations have been established.

4.7 STRUCTURALLY SUPPORTED FLOOR SLAB AND CRAWLSPACE

A structural main floor underlain by a crawlspace may be supported on piles designed using the foundation design recommendations presented in this report. Prior to construction of the slab, the footprint of the slab should be cleared and stripped of all vegetation and organics (i.e. topsoil, organic soil, etc.) if encountered and rough graded such that a minimum gradient of 4 percent is provided towards interior collection lines and sumps.

The underlying crawlspace should extend to a minimum of 150 mm below the bottom of the lowest floor beam or joist, and the crawl space floor should be covered with a vapour barrier and a 100 mm thick protective sand cover on top of the vapour barrier. The crawl space should also be heated, ventilated and drained with an interior drainage collection system as outlined in Section 4.8.

4.8 ASPHALT PAVEMENT

4.8.1 GENERAL

Recommended pavement sections and subgrade preparation measures outlined herein have been presented on the assumption that parking lot surface design grades will be located within about plus or minus 0.3 m of existing grade.

Based on information outlined on test hole log, subgrade conditions following excavation for the pavements section recommended herein is expected to consist of clay fill with in-situ moisture content currently near optimum, underlain by very moist to wet silt (low plastic clay) at about 0.6 m to 0.8 m below pavement subgrade elevation. Subject to favourable proof rolling results as per the subgrade preparation

recommendations outlined in Section 4.6.2, full depth removal of clay fill is not likely to be required. Notwithstanding, WSP cautions variations in the depth to silt across the site could give rise to soft subgrade conditions during construction, particularly if excavation to pavement subgrade elevation extends through the clay fill and into the underlying silt. Where silt is encountered at pavement subgrade elevation, construction of a gravel bridging layer may be required to establish workable subgrade conditions. It is envisaged the bridging layer could consist of a 300 mm to 400 mm thick layer of 150 mm minus crushed limestone underlain by a geotextile separator, such as Propex 350 ST.

With respect to maintenance, all pavements, no matter the pavement type, are subject to routine annual maintenance and upkeep essential to maintaining the pavement investment at a specified level of service, and to mitigate the rate of deterioration of the pavement. The annual maintenance is required to repair normal 'wear and tear' and environmental damages, and may include, but not be limited to, crack sealing or seal coating, patching, routing, or dowel joint repairs. In addition, un-maintained pavements are more susceptible to developing serious cracks or structural defects requiring earlier replacement than properly maintained pavements. By mitigating the deterioration of the pavement structure, particularly at depth, a properly maintained pavement could provide for an increased number of pavement rehabilitation alternatives when the design life of the pavement has been achieved.

A program of regularly scheduled maintenance should be undertaken to preserve the integrity of the pavement structure. During pavement service life, heavy vehicle traffic should be limited to heavy duty pavement areas. Cracks in pavement should be sealed as soon as possible to prevent moisture infiltration into the pavement subgrade. Drainage paths should be maintained to allow the free flow of surface water away from the structure and pavements, such as through regular cleanouts in catch basins.

4.8.2 ASPHALT PAVEMENT SECTIONS

The following asphalt pavement sections are intended as minimums for the design of pavement structures. Design traffic loading information was not available at the time of this report, and in this regard, assumption of anticipated traffic loads and design life were required for providing pavement recommendations. Recommended pavement sections outlined here-in have been provided based on the use of the area by cars with some light truck traffic (i.e. 1-Ton trucks or lighter). Asphalt pavement recommendations for heavy truck traffic areas have also been provided based on the areas being used by fully loaded highway-legal tractor trailers at frequency of less than 5 trucks per day.

Subsequent pavement sections have been established based on an assumed effective subgrade resilient modulus (Mr) of 20 MPa, or an approximately equivalent California Bearing Ratio of 2.0 percent. The above subgrade resilient modulus is indicative of a relatively low level of subgrade support as is expected during spring thaw when the clay subgrade could exist in a weakened condition. If softened areas are present in the subgrade during construction, it may be necessary to incorporate additional gravel to establish a stable subgrade. Recommendations for additional gravel thickness should be made in the field based on observations made during site grading.

Table 4-5: Flexible Asphalt Pavement Design Sections

Material	Recommended Minimum Thickness (mm)

	Passenger Vehicles	Truck Traffic
Dense Hot Mix Asphalt	65	80
20 mm minus Crushed Limestone Base Course	150	150
50 mm minus Crushed Limestone Sub-base	200	300
Total Structure Depth	**415**	**530**

[1] Gradations for crushed limestone sub-base and crushed limestone base course outlined in City of Winnipeg Specification CW3110-R14 for are recommended.

The proposed pavement sections are also based on the assumption of a properly compacted pavement structure constructed on a stable subgrade prepared in accordance with subgrade preparation recommendations for grade supported slabs outlined in Section 4.6.2. Outlined below are additional construction recommendations pertaining to asphalt pavement sections:

- The granular subbase should be placed in maximum 200 mm thick lifts (or reduced lift thicknesses as governed by the compactive abilities of the compaction equipment) and uniformly compacted to a minimum of 98 percent of SPMDD at ± 2 percent of OMC to the bottom of the base course design elevation.
- The granular base course should be placed in maximum 200 mm thick lifts (or reduced lift thicknesses as governed by the compactive abilities of the compaction equipment) and uniformly compacted to a minimum 100 percent of SPMDD at ± 2 percent of OMC to the bottom of the asphalt design elevation.
- Qualified geotechnical personnel should monitor the quality and placement of gravel and the compaction of the gravel should be monitored by field density testing at regular frequencies. The density of each lift should be tested to confirm that adequate compaction has been achieved before placing the next lift.
- Asphalt should be compacted to a minimum 98 percent of a 50 blow Marshall Density.
- All granular and asphalt materials should meet City of Winnipeg Construction Specifications. Base course and sub-base materials should reflect the grading specifications outlined in City of Winnipeg Construction Specifications CW3110-R14.

Concrete pavement sections should be provided for any areas where the heavy static wheel loads such as garbage trucks will bear during unloading of dumpsters, and for any areas where trailer "dollies" will bear on the pavement. Asphalt pavement used in such areas is at high risk of rutting, and normally develops ruts within a short time.

4.9 FINAL SITE GRADING, SURFACE DRAINAGE, AND SUBDRAINAGE

Sufficient gradients should be provided to promote surface drainage away from the proposed facility in order to reduce the potential for moisture percolation to the foundation elements. Site grading should provide

positive drainage away from structures at a minimum gradient of 4 percent for landscaped areas within 3 m of the perimeter of the building; and at a minimum gradient of 2 percent for all pavement areas and landscape areas outside of 3 m of the building perimeter. Further to surfaces grades, all downspouts from the roof of the structure should be discharged away from the building and proper measures (i.e. splashguards) should be provided where necessary to limit the potential for erosion and ponding water at the perimeter of the structure.

Excavations at the perimeter of the addition (grade beams, footings, etc.) should be backfilled with moderately to well compacted fill, topped with a clay cap a minimum of 0.3 m thick to limit the amount of surface water infiltration into the slab subgrade or granular backfill against grade beams. As a recommended minimum, the clay cap in landscape areas along the perimeter of the foundation should extend a minimum of 3.0 m from the foundation perimeter. Where pavement and/or concrete slabs meet the structure, these should be sealed against abutting structural components with a flexible seal, such as an asphaltic bead, to minimize surface water infiltration into the granular layer below the floor slab.

Where a structurally supported main floor slab is provided over a crawl space, a subdrainage system is recommended, particularly if the shallow silt layer is encountered within the depth of the crawlspace. The subdrainage system should consist of a perimeter drain along the exterior perimeter of the building to limit potential groundwater accumulation along foundation elements as well as to limit the ingress of percolating run-off into the underlying crawlspace. Furthermore, an interior drainage collection system consisting of a minimum of one central collection line should be installed within the crawlspace to collect potential seepage into the crawlspace from shallow silt common in Winnipeg clays. The interior drainage collection system should be independent of the perimeter drain system. In order to facilitate gravity drainage of seepage into the crawlspace, grades within the crawlspace should be sloped towards collection lines at a minimum of 2 percent, and ideally, 4 percent.

Perimeter drains and interior collection lines should consist of a minimum 100 mm diameter filter-wrapped perforated PVC pipe placed in trenches backfilled with free draining 40 mm minus drainage gravel. The trenches should be of sufficient width and depth such that a minimum 150 mm thick layer of drainage gravel is maintained above and along the sides of the drain pipe below the finished surface of the crawlspace. Drainage gravel used to backfill the trenches should consist of natural gravel or crushed stone having clean, hard, strong, durable, uncoated particles free from injurious amounts of soft, friable, thin, elongated or laminated pieces, alkali, organic or other deleterious matter, and should meet the following gradation requirement:

Table 4-6: Drainage Material Grading requirement

Sieve size (Square Openings)	Percent Passing by Weight
40 mm	100
25 mm	50 - 80
20 mm	5 - 20
12.5 mm	0 - 5
0.08 mm	0 – 3

Drainage from subdrainage lines should be directed to one or more positive outlets such as a central collecting sump(s); or by gravity flow directly into the sewer system assuming applicable authorities permit. Where drainage is directed to a sump located below the building footprint, interior lateral drainage lines passing beneath the building should consist of solid pipe. Depending on final elevations and site configuration, grading

of the crawlspace may necessitate installation of numerous interior drain lines and/or drainage outlets (i.e. sumps) to control slope lengths and drainage line lengths.

4.10 FOUNDATION CONCRETE

Where concrete elements outlined in this report and all other concrete in contact with the local soil will be subjected in service to weathering, sulphate attack, a corrosive environment, or saturated conditions, the concrete should be designed, specified, and constructed in accordance with concrete exposure classifications outlined in the latest edition of CSA standard A23.1, Concrete Materials and Methods of Concrete Construction. In addition, all concrete must be supplied in accordance with current Manitoba and National Building Code requirements.

Based on significant data gathered through previous work in the Winnipeg area, water soluble sulphate concentrations in the soil are typically in the range of 0.2% to 2.0%. As such, the degree of sulphate exposure at the site may be considered as 'severe' in accordance with current CSA standards, and the use of sulphate resistance cement (Type HS or HSb) is recommended for concrete in contact with the local soil. Furthermore, air entrainment should be incorporated into any concrete elements that are exposed to freeze-thaw to enhance its durability.

It should be recognized that there may be structural and other considerations, which may necessitate additional requirements for subsurface concrete mix design.

4.11 CONSTRUCTION MONITORING AND TESTING

All engineering design recommendations presented in this report are based on the assumption that an adequate level of testing and monitoring will be provided during construction and that all construction will be carried out by a suitably qualified contractor experienced in foundation and earthworks construction. An adequate level of testing and monitoring is considered to be:

- for earthworks: full-time monitoring and compaction testing.
- for deep foundations: design review and full-time monitoring during construction.
- for concrete construction: testing of plastic and hardened concrete in accordance with CSA A23.1-04 and A23.2-04; and review of concrete supplier's mix designs for conformance with prescribed and/or performance concrete specifications.

WSP requests the opportunity to review the design drawings, and the installation of the foundations, to confirm that the geotechnical recommendations have been correctly interpreted. WSP would be pleased to provide any further information that may be needed during design and to advise on the geotechnical aspects of specifications for inclusion in contract documents.

5 CLOSURE

The findings and recommendations presented in this report were based on geotechnical evaluation of the subsurface conditions observed during the site investigation described in this report. If conditions other than those reported in this report are noted during subsequent phases of the project, or if the assumptions stated

herein are not in keeping with the design, this office should be notified immediately in order that the recommendations can be verified and revised as required. Recommendations presented herein may not be valid if an adequate level of inspection is not provided during construction, or if relevant building code requirements are not met.

The 2014 Geotechnical Investigation described in this report was for the sole purpose of identifying geotechnical conditions at the project Site. Although no environmental issues were identified during the fieldwork, this does not indicate that no such issues exist. If the owner or other parties have any concern regarding the presence of environmental issues, then an appropriate level environmental assessment should be conducted.

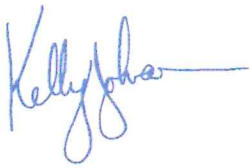
Soil conditions, by their nature, can be highly variable across a site. The placement of fill and prior construction activities on a site can contribute to the variability especially in near surface soil conditions. A contingency should always be included in any construction budget to allow for the possibility of variation in soil conditions, which may result in modification of the design and construction procedures.

This report has been prepared for the exclusive use of Crosier Kilgour and Partners, and their agents, for specific application to the project described in this report. The data and recommendations provided herein should not be used for any other purpose, or by any other parties, without review and written advice from WSP. Any use that a third party makes of this report, or any reliance or decisions made based on this report, are the responsibility of those parties. WSP accepts no responsibility for damages suffered by a third party as a result of decisions made or actions based on this report.

This report has been prepared in accordance with generally accepted soil and foundation engineering practices. No other warranty, either expressed or implied, is made.

Respectfully submitted,

WSP E&I Canada Limited



Kelly Johnson, P. Eng.

Principal Geotechnical Engineer

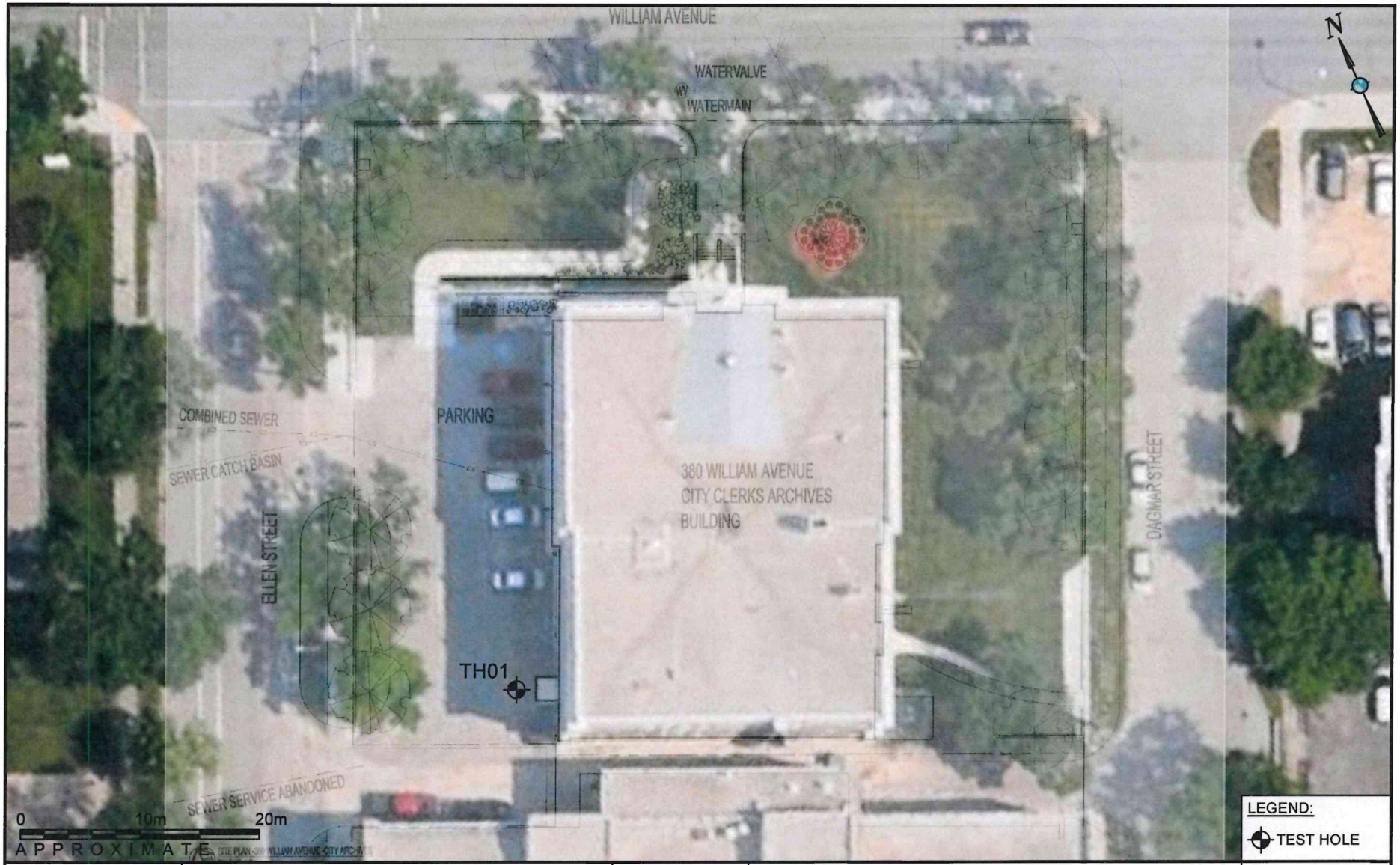
Reviewed by:

Brad Wiebe, M.Sc., P.Eng.

Associate Geotechnical Engineer

Manager of Geotechnical Services

FIGURES



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CLIENT

Winnipeg

CLIENT

CITY OF WINNIPEG

AMEC Environment & Infrastructure
440 DOVERCOURT DRIVE
WINNIPEG, MANITOBA R3Y 1N4
PHONE: 204.488.2997 FAX:204.489.8261

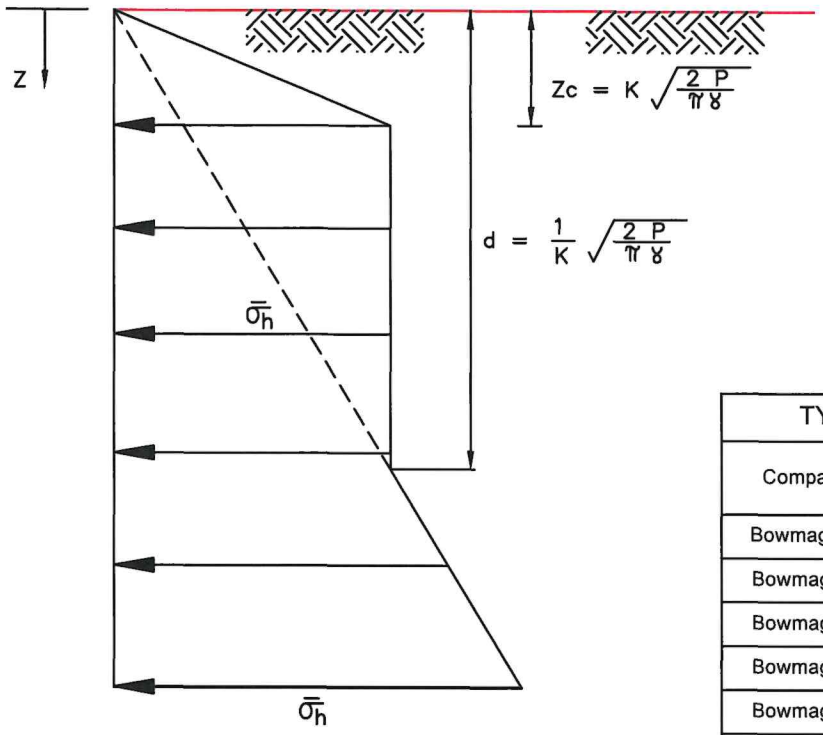
amec

DWN BY:	MD
CHK'D BY:	AJ
DATUM:	NAD83
PROJECTION:	UTM Zone 14 U
SCALE:	AS SHOWN

GEOTECHNICAL INVESTIGATION
CITY ARCHIVES BUILDING EXPANSION DEVELOPMENT
380 WILLIAM AVENUE
WINNIPEG, MANITOBA

TEST HOLE LOCATION PLAN

REV. NO.:	A
DATE:	JANUARY 2014
PROJECT NO:	WX17307
FIGURE No.	FIGURE 1



EARTH PRESSURE DISTRIBUTION

FOR $Zc \leq Z \leq d$

$$\bar{\sigma}_h = \sqrt{\frac{2P\gamma}{\pi}}$$

FOR $Z > d$

$$\bar{\sigma}_h = K \cdot \gamma \cdot Z$$

TYPICAL COMPACTOR LOADS (P)			
Compactor	LOAD (P) kN/m	Compactor	LOAD (P) kN/m
Bowmag TSE	31	Bowmag BW122PD	36
Bowmag 60S	32	Bowmag 142PDB	47
Bowmag 65S	22	Bowmag 172PDB	93
Bowmag 75S	33	Dynapac LR100	42
Bowmag 90S	39	Dynapac 2100V	93
Bowmag 75AD	20	Dynapac CA121D	53
Bowmag 100AD	20	Dynapac CA121PD	54
Bowmag 120AD	34	Dynapac CA151	80
Bowmag 130AD	36	Dynapac CA151D	80
Bowmag BW122D	30	Dynapac CA151PD	96

P (ROLLER LOAD) = $\frac{\text{DEAD WT. OF ROLLER + CENTRIFUGAL FORCE}}{\text{WIDTH OF ROLLER}}$

TYPICAL VALUES GIVEN IN TABLE

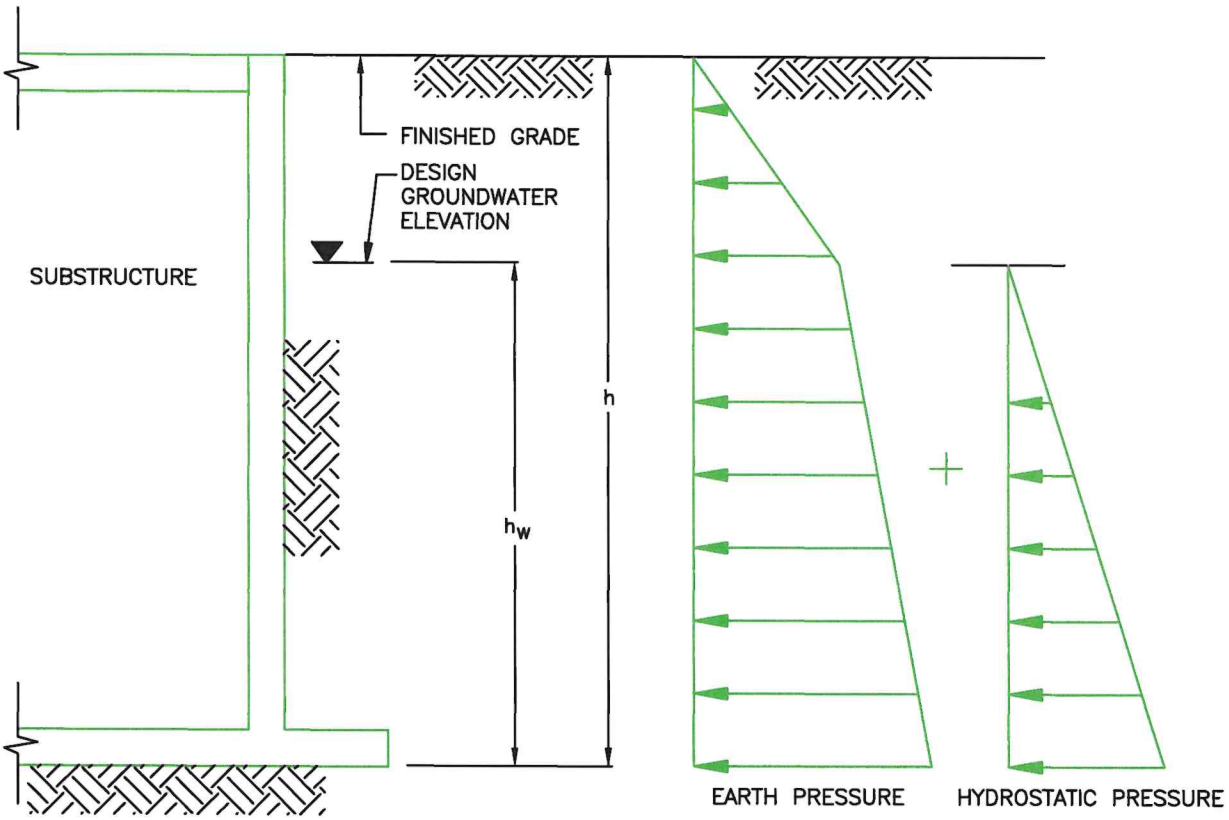
EARTH PRESSURE COEFFICIENTS

$K = K_o$ ("AT REST") OR K_a (ACTIVE CASE)
(SEE TEXT OF REPORT)

γ = SOIL UNIT WEIGHT
(SEE TEXT OF REPORT)

CLIENT: Winnipeg CITY OF WINNIPEG	DWN BY: MD CHK'D BY: KJ	GEOTECHNICAL INVESTIGATION CITY ARCHIVES BUILDING EXPANSION DEVELOPMENT 380 WILLIAM STREET WINNIPEG, MANITOBA	DATE: JANUARY 2014 PROJECT No.: WX17307 REV. No.: -
AMEC Earth & Environmental 5681-70 STREET, EDMONTON, ALBERTA, T6B 3P6 PHONE 780-436-2152, FAX 780-435-8425	DATUM: - PROJECTION: - SCALE: NOT TO SCALE	LATERAL EARTH PRESSURES INDUCED BY COMPACTION	FIGURE No.: FIGURE 2

P:\Jobs\17300's\17300's\17307 - CKP - 380 William\Drawings\LAT PRESSURE - FIG 2.dwg - F2 - Jan, 21, 2014 9:09 AM - matthews.dolores



RECOMMENDED PRESSURE DISTRIBUTION

$$P_h = K\gamma(h-h_w) + K\gamma' h_w + \gamma_w h_w$$

WHERE: P_h = LATERAL EARTH PRESSURE (kPa)

γ = UNIT WEIGHT OF SOIL (SEE TEXT OF REPORT)

γ' = BUOYANT UNIT WEIGHT OF SOIL (SEE TEXT OF REPORT)

γ_w = UNIT WEIGHT OF WATER (USE $\gamma_w = 9.8\ kN/m^3$)

h = HEIGHT OF WALL FROM FINISHED GRADE TO BASE OF WALL (m)

h_w = HEIGHT OF GROUNDWATER TABLE ABOVE BASE OF WALL (m)

K = LATERAL EARTH PRESSURE COEFFICIENT (K_a OR K_o – SEE REPORT TEXT)

NOTES:

1. SEE TEXT OF REPORT FOR UNIT WEIGHTS AND LATERAL EARTH PRESSURE COEFFICIENTS.
2. A HYDROSTATIC COMPONENT NEED ONLY BE INCLUDED WHERE A PERCHED GROUND WATER TABLE WERE TO OCCUR WITHIN THE LEVEL OF SUB–STRUCTURE IN COMBINATION WITH NO SUB–DRAINAGE.

CLIENT: CITY OF WINNIPEG	DWN BY: MD CHK'D BY: KJ	GEOTECHNICAL INVESTIGATION CITY ARCHIVES BUILDING EXPANSION DEVELOPMENT 380 WILLIAM STREET WINNIPEG, MANITOBA	DATE: JANUARY 2014 PROJECT No.: WX17307 REV. No.: -
AMEC Earth & Environmental 5681-70 STREET, EDMONTON, ALBERTA, T6B 3P6 PHONE 780-436-2152, FAX 780-435-8425	DATUM: - PROJECTION: - SCALE: NOT TO SCALE	LATERAL EARTH PRESSURES FOR LIGHTLY COMPACTED BACKFILL	FIGURE No.: FIGURE 3

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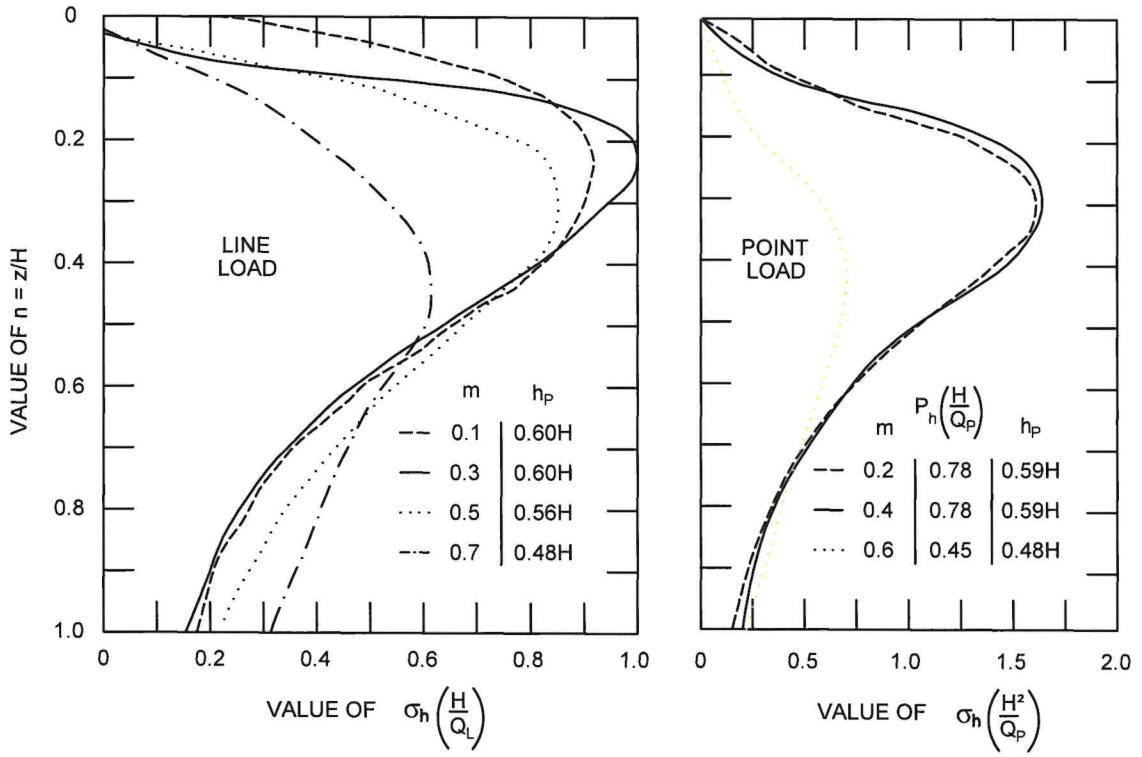
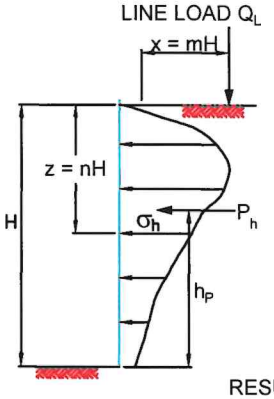




FOR m ≤ 0.4:

$$\sigma_h\left(\frac{H}{Q_L}\right) = \frac{0.20n}{(0.16 + n^2)^2}$$

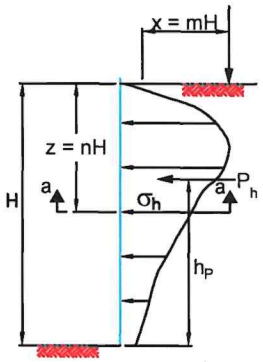
$$P_h = 0.55\ Q_L$$

FOR m > 0.4:

$$\sigma_h\left(\frac{H}{Q_L}\right) = \frac{1.28m^2n}{(m^2 + n^2)^2}$$

RESULTANT $P_h = \frac{0.64\ Q_L}{(m^2 + 1)}$

PRESSURES FROM LINE LOAD
(BOUSSINESQ EQUATION MODIFIED BY EXPERIMENT)



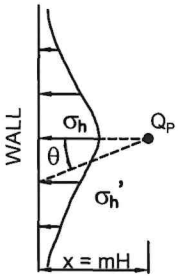
FOR m ≤ 0.4:

$$\sigma_h\left(\frac{H^2}{Q_P}\right) = \frac{0.28n^2}{(0.16 + n^2)^3}$$

FOR m > 0.4:

$$\sigma_h\left(\frac{H^2}{Q_P}\right) = \frac{1.77m^2n^2}{(m^2 + n^2)^3}$$

$$\sigma_h' = \sigma_h \cos^2(1.1\theta)$$



SECTION a-a
PRESSURES FROM POINT LOAD
(BOUSSINESQ EQUATION
MODIFIED BY EXPERIMENT)

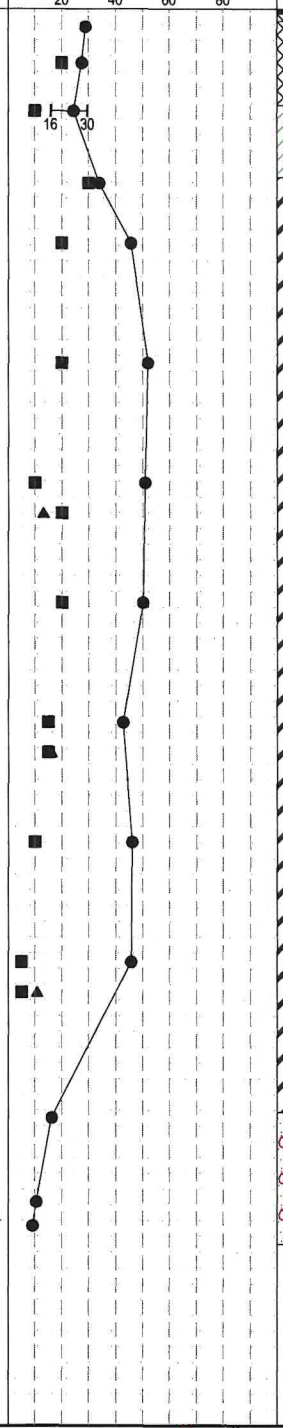
CLIENT: CITY OF WINNIPEG	DWN BY: MD	GEOTECHNICAL INVESTIGATION CITY ARCHIVES BUILDING EXPANSION DEVELOPMENT 380 WILLIAM STREET WINNIPEG, MANITOBA	DATE: JANUARY 2014
	CHK'D BY: KJ		PROJECT No.: WX17307
AMEC Earth & Environmental 5681-70 STREET, EDMONTON, ALBERTA, T6B 3P6 PHONE 780-436-2152, FAX 780-435-8425	DATUM: -		REV. No.: -
	PROJECTION: -		
	SCALE: NOT TO SCALE	LATERAL PRESSURES DUE TO SURCHARGE POINT AND LINE LOADS	FIGURE No.: FIGURE 4

APPENDIX A: TEST HOLE LOGS

PROJECT: Geotechnical Investigation	DRILLED BY: Maple Leaf Drilling Ltd.	BORE HOLE NO: **TH01**
CLIENT: City of Winnipeg	DRILL TYPE: B40	PROJECT NO: WX17307
LOCATION: 380 William Avenue	DRILL METHOD: 125 mm SSA	ELEVATION: 97.9 m

SAMPLE TYPE: Shelby Tube; No Recovery; SPT (N); Grab Sample; Split-Pen; Core

BACKFILL TYPE: Bentonite; Pea Gravel; Drill Cuttings; Grout; Slough; Sand



Depth (m)	SOIL SYMBOL	MUSCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	COMMENTS	ELEVATION (m)
0		GP	ASPHALT - 50 mm thick asphalt		1			97
			GRANULAR FILL - poorly graded, medium grained, frozen					
		CH	CLAY (FILL) - silty, high plastic, frozen, dark grey, some gravel		2			
1								
			SILT - clayey, low plastic, very moist to wet, soft to firm, brown		3			
		CL						
2								96
			CLAY - silty, high plastic, moist, stiff, brown		4			
3					5			95
4								94
					6			
5								93
					7			
6			- firm below 6.1 m		8		- slight squeezing from silt layer when drilled to 6.1 m Unconfined Compressive Test @ 6.4 m: Max. Compressive Stress = 65.8 kPa @ 4.3% strain Bulk Density = 1717.7 kg/m^3 Dry Density = 1118.6 kg/m^3	92
7								91
					9			
8		CH						90
					10			
9					11			89
							Unconfined Compressive Test @ 9.4 m: Max. compressive stress = 81.6 kPa @ 4.2% strain Bulk Density = 1771.5 kg/m^3 Dry Density = 1191.1 kg/m^3	
10								88
			- soft with occasional sulphate inclusions below 10.7 m		12			
11								87
					13			
12					14		Unconfined Compressive Test @ 12.5 m: Max. compressive stress = 54.5 kPa @ 7.9% strain Bulk Density = 1798.6 kg/m^3 Dry Density = 1261.2 kg/m^3	86
13								85
			SILT (TILL) - some clay, trace sand and gravel, low plastic, moist, compact (inferred), grey		15			
14			- trace clay, some sand and gravel, damp, very dense below 14.6 m					84
		ML			16			
15					17	98/225		83
			AUGER REFUSAL AT 15.7 m ON SUSPECTED BEDROCK OR BOULDER Notes: - slight necking from 9.1 m to 10.7 m and slight seepage from 1.2 m to 2.1 m (from silt layer) observed upon completion of drilling. - backfilled with auger cuttings and bentonite.					
16								82
17								81
18								80

amec	**AMEC Environment & Infrastructure Winnipeg, Manitoba**	LOGGED BY: JW	COMPLETION DEPTH: 15.7 m
		REVIEWED BY: KJ	COMPLETION DATE: 9 December 2013
		Figure No. A1	Page 1 of 1

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EXPLANATION OF TERMS AND SYMBOLS

The terms and symbols used on the borehole logs to summarize the results of field investigation and subsequent laboratory testing are described in these pages.

It should be noted that materials, boundaries and conditions have been established only at the borehole locations at the time of investigation and are not necessarily representative of subsurface conditions elsewhere across the site.

TEST DATA

Data obtained during the field investigation and from laboratory testing are shown at the appropriate depth interval.

Abbreviations, graphic symbols, and relevant test method designations are as follows:

*C	Consolidation test	*ST	Swelling test
D_R	Relative density	TV	Torvane shear strength
*k	Permeability coefficient	VS	Vane shear strength
*MA	Mechanical grain size analysis	w	Natural Moisture Content (ASTM D2216)
	and hydrometer test	w_l	Liquid limit (ASTM D 423)
N	Standard Penetration Test (CSA A119.1-60)	w_p	Plastic Limit (ASTM D 424)
N_d	Dynamic cone penetration test	E_f	Unit strain at failure
NP	Non plastic soil	γ	Unit weight of soil or rock
pp	Pocket penetrometer strength	γ_d	Dry unit weight of soil or rock
*q	Triaxial compression test	ρ	Density of soil or rock
q_u	Unconfined compressive strength	ρ_d	Dry Density of soil or rock
*SB	Shearbox test	C_u	Undrained shear strength
SO_4	Concentration of water-soluble sulphate	→	Seepage
		▼	Observed water level

* The results of these tests are usually reported separately

Soils are classified and described according to their engineering properties and behaviour.

The soil of each stratum is described using the Unified Soil Classification System[1] modified slightly so that an inorganic clay of "medium plasticity" is recognized.

The modifying adjectives used to define the actual or estimated percentage range by weight of minor components are consistent with the Canadian Foundation Engineering Manual[2].

Relative Density and Consistency:

Cohesionless Soils

Relative Density	SPT (N) Value
Very Loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

Cohesive Soils

Consistency	Undrained Shear Strength c_u (kPa)	Approximate SPT (N) Value
Very Soft	0-12	0-2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

Standard Penetration Resistance ("N" value)
The number of blows by a 63.6kg hammer dropped 760 mm to drive a 50 mm diameter open sampler attached to "A" drill rods for a distance of 300 mm after an initial penetration of 150 mm.

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1 "Unified Soil Classification System", Technical Memorandum 36-357 prepared by Waterways Experiment Station, Vicksburg, Mississippi, Corps of Engineers, U.S. Army. Vol. 1 March 1953.

2 "Canadian Foundation Engineering Manual", 3rd Edition, Canadian Geotechnical Society, 1992.

MODIFIED UNIFIED CLASSIFICATION SYSTEM FOR SOILS

MAJOR DIVISIONS			SYMBOLS: USCS	SYMBOLS: GRAPH	SYMBOLS: COLOUR	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA
COARSE GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75um)	GRAVELS MORE THAN HALF THE COARSE FRACTION LARGER THAN 4.75mm	CLEAN GRAVELS (TRACE OR NO FINES)	GW		RED	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	$C_u=D_{60}/D_{10}$ >4; $C_c=(D_{30})^2/(D_{10}xD_{60})$ = 1 to 3
			GP		RED	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
		DIRTY GRAVELS (WITH SOME OR MORE FINES)	GM		YELLOW	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR PI LESS THAN 4
			GC		YELLOW	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	ATTERBERG LIMITS ABOVE "A" LINE AND PI MORE THAN 7
	SANDS MORE THAN HALF THE COARSE FRACTION SMALLER THAN 4.75mm	CLEAN SANDS (TRACE OR NO FINES)	SW		RED	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_u=D_{60}/D_{10}$ >6; $C_c=(D_{30})^2/(D_{10}xD_{60})$ = 1 to 3
			SP		RED	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
		DIRTY SANDS (WITH SOME OR MORE FINES)	SM		YELLOW	SILTY SANDS, SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR PI LESS THAN 4
			SC		YELLOW	CLAYEY SANDS, SAND-CLAY MIXTURES	ATTERBERG LIMITS ABOVE "A" LINE AND PI MORE THAN 7
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75um)	SILTS BELOW "A" LINE NEGLIGIBLE ORGANIC CONTENT	W_L < 50%	ML		GREEN	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (SEE BELOW)
		W_L > 50%	MH		BLUE	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SAND OR SILTY SOILS	
	CLAYS ABOVE "A" LINE NEGLIGIBLE ORGANIC CONTENT	W_L < 30%	CL		GREEN	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY OR SILTY CLAYS, LEAN CLAYS	
		30% < W_L < 50%	CI		GREEN-BLUE	INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS	
		W_L > 50%	CH		BLUE	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	ORGANIC SILTS & CLAYS BELOW "A" LINE	W_L < 50%	OL		GREEN	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	WHENEVER THE NATURE OF THE FINES CONTENT HAS NOT BEEN DETERMINED, IT IS DESIGNATED BY THE LETTER "F", E.G. SF IS A MIXTURE OF SAND WITH SILT OR CLAY
		W_L > 50%	OH		BLUE	ORGANIC CLAYS OF HIGH PLASTICITY	
HIGHLY ORGANIC SOILS			PT		ORANGE	PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOUR OR ODOUR, AND OFTEN FIBROUS TEXTURE

SPECIAL SYMBOLS

LIMESTONE		OILSAND	
SANDSTONE		SHALE	
SILTSTONE		FILL (UNDIFFERENTIATED)	

SOIL COMPONENTS

FRACTION	U.S. STANDARD METRIC SIEVE SIZE		DEFINING RANGES OF PERCENT BY WEIGHT OF MINOR COMPONENTS	
GRAVEL	PASSING	RETAINED	PERCENT	DESCRIPTOR
COARSE	76mm	19mm	35 - 50	AND
FINE	19mm	4.75mm		
SAND			30 - 35	Y / EY
COARSE	4.75mm	2.00mm		
MEDIUM	2.00mm	425µm	10 - 20	SOME
FINE	425µm	75µm		
FINES (SILT OR CLAY BASED ON PLASTICITY)	75µm		1 - 10	TRACE

OVERSIZED MATERIAL

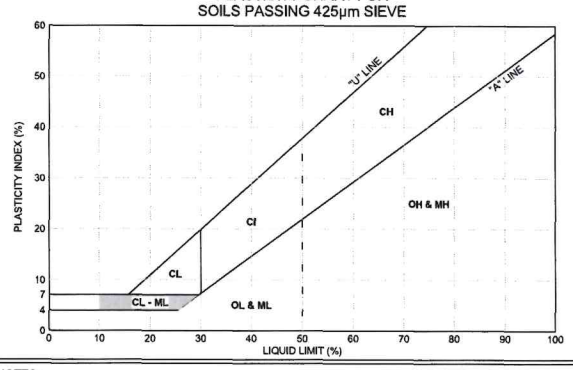
ROUNDED OR SUBROUNDED:

COBBLES 76mm to 200mm
BOULDERS > 200mm

NOT ROUNDED:

ROCK FRAGMENTS ? 76mm
ROCKS > 0.76 CUBIC METRE IN VOLUME

PLASTICITY CHART FOR SOILS PASSING 425µm SIEVE



NOTES:

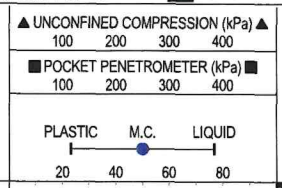
1. ALL SIEVE SIZES MENTIONED ARE U.S. STANDARD ASTM E.11.
2. COARSE GRAINED SOILS WITH TRACE TO SOME FINES GIVEN COMBINED GROUP SYMBOLS, E.G. GW-GC IS A WELL GRADED GRAVEL SAND MIXTURE WITH TRACE TO SOME CLAY.
3. DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS.

AMEC Environment & Infrastructure
a Division of AMEC Americas Limited

PROJECT: Geotechnical Investigation	DRILLED BY: Maple Leaf Drilling Ltd.	BORE HOLE NO: **TH01**
CLIENT: City of Winnipeg	DRILL TYPE: B40	PROJECT NO: WX17307
LOCATION: 380 William Avenue	DRILL METHOD: 125 mm SSA	ELEVATION: 97.9 m

SAMPLE TYPE: Shelby Tube; No Recovery; SPT (N); Grab Sample; Split-Pen; Core

BACKFILL TYPE: Bentonite; Pea Gravel; Drill Cuttings; Grout; Slough; Sand



Depth (m)	SOIL SYMBOL	MUSCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	COMMENTS	ELEVATION (m)
0		GP	ASPHALT - 50 mm thick asphalt		1			97
			GRANULAR FILL - poorly graded, medium grained, frozen					
1		CH	CLAY - silty, high plastic, frozen, dark grey, some gravel		2			
			SILT - clayey, low plastic, very moist to wet, soft to firm, brown		3			96
2		CL						
			CLAY - silty, high plastic, moist, stiff, brown		4			
3					5			95
4								94
					6			
5								93
6			- firm below 6.1 m		7			92
					8		- slight squeezing from silt layer when drilled to 6.1 m Unconfined Compressive Test @ 6.4 m: Max. Compressive Stress = 65.8 kPa @ 4.3% strain Bulk Density = 1717.7 kg/m^3 Dry Density = 1118.6 kg/m^3	
7								91
					9			
8		CH						90
9					10			89
					11		Unconfined Compressive Test @ 9.4 m: Max. compressive stress = 81.6 kPa @ 4.2% strain Bulk Density = 1771.5 kg/m^3 Dry Density = 1191.1 kg/m^3	
10								88
			- soft with occasional sulphate inclusions below 10.7 m		12			
11								87
12					13			86
					14		Unconfined Compressive Test @ 12.5 m: Max. compressive stress = 54.5 kPa @ 7.9% strain Bulk Density = 1798.6 kg/m^3 Dry Density = 1261.2 kg/m^3	
13								85
14			SILT (TILL) - some clay, trace sand and gravel, low plastic, moist, compact (inferred), grey		15			84
		ML	- trace clay, some sand and gravel, damp, very dense below 14.6 m		16			
15					17	98/225		83
			AUGER REFUSAL AT 15.7 m ON SUSPECTED BEDROCK OR BOULDER					
16			Notes: - slight necking from 9.1 m to 10.7 m and slight seepage from 1.2 m to 2.1 m (from silt layer) observed upon completion of drilling. - backfilled with auger cuttings and bentonite.					82
17								81
18								80

amec

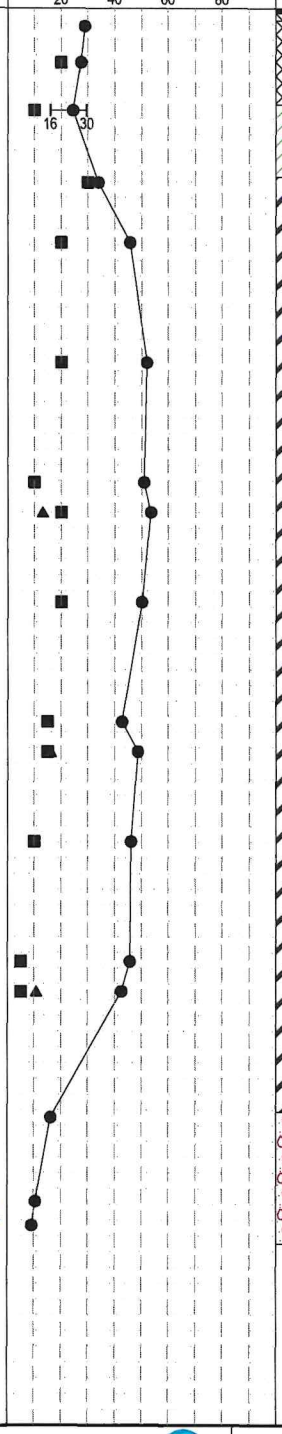
AMEC
Winnipeg, Manitoba

LOGGED BY: JW	COMPLETION DEPTH: 15.7 m
REVIEWED BY: KJ	COMPLETION DATE: 9 December 2013
Figure No. A1	Page 1 of 1

PROJECT: Geotechnical Investigation	DRILLED BY: Maple Leaf Drilling Ltd.	BORE HOLE NO: **TH01**
CLIENT: City of Winnipeg	DRILL TYPE: B40	PROJECT NO: WX17307
LOCATION: 380 William Avenue	DRILL METHOD: 125 mm SSA	ELEVATION: 97.9 m

SAMPLE TYPE: Shelby Tube; No Recovery; SPT (N); Grab Sample; Split-Pen; Core

BACKFILL TYPE: Bentonite; Pea Gravel; Drill Cuttings; Grout; Slough; Sand



Depth (m)	SOIL SYMBOL	MUSCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	COMMENTS	ELEVATION (m)
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1								
		CL	SILT - clayey, low plastic, very moist to wet, soft to firm, brown		3			
2								96
			CLAY - silty, high plastic, moist, stiff, brown		4			
3					5			95
4								94
					6			
5								93
6					7			92
			- firm, grey below 6.1 m		8		- slight squeezing from silt layer when drilled to 6.1 m Unconfined Compressive Test @ 6.4 m: Max. Compressive Stress = 65.8 kPa @ 4.3% strain Bulk Density = 1717.7 kg/m^3 Dry Density = 1118.6 kg/m^3	
7								91
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9					10			89
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10								88
			- soft with occasional sulphate inclusions below 10.7 m		12			
11								87
12					13			86
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13								85
14			SILT (TILL) - some clay, trace sand and gravel, low plastic, moist, compact (inferred), grey		15			84
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16			AUGER REFUSAL AT 15.7 m ON SUSPECTED BEDROCK OR BOULDER Notes: - slight necking from 9.1 m to 10.7 m and slight seepage from 1.2 m to 2.1 m (from silt layer) observed upon completion of drilling. - backfilled with auger cuttings and bentonite.					82
17								81
18								80

amec	**AMEC** **Winnipeg, Manitoba**	LOGGED BY: JW	COMPLETION DEPTH: 15.7 m
		REVIEWED BY: KJ	COMPLETION DATE: 9 December 2013
		Figure No. A1	Page 1 of 1

17307 - CKP - 380 WILLIAM.GPJ 14/01/24 02:52 PM (GEOTECHNICAL REVISED)

APPENDIX B

HAZARDOUS MATERIALS ASSESSMENT

November 3, 2023

TESSERACT
ENVIRONMENTAL CONSULTING INC.

Hazardous Materials Gap Analysis

City of Winnipeg Archives Building
380 William Avenue
Winnipeg, Manitoba

Submitted to:

Mr. Daniel Long
MCM Architects Inc.
141 St. Anne's Road
Winnipeg, Manitoba
R2M 2Z3

Hazardous Building Materials

TABLE OF CONTENTS

1.0 INTRODUCTION

Tesseract Environmental Consulting Inc. (TEC) was retained by MCM Architects Inc. (the Client) to complete a hazardous materials gap analysis throughout the City of Winnipeg Archives Building located at 380 William Avenue in Winnipeg, Manitoba. The assessment was conducted on October 13, 2023 by Mr. Trevor Bage of TEC.

Prior to the assessment, TEC was provided with a comprehensive inventory which listed the known hazardous materials and confirmed non-hazardous materials throughout the Site and relied on it in good faith when completing the gap analysis. Based on this information, TEC reviewed the Site to assess for any materials which had not been previously sampled or identified.

This report has been compiled to assist the Client in meeting the requirements of Section 4 – Duties of Employers, of Chapter W210 10/02 The Workplace Safety and Health Act as amended, Manitoba Regulation 217/2006 Part 37, and the Manitoba documents, entitled *The Guide for Asbestos Management (November 2020)*.

2.0 SCOPE OF WORK

The Scope of Work for this project was limited to the following:

- Conduct a visual assessment of the specific Site locations that are scheduled for impact to determine the location and condition of suspected hazardous materials
- Conduct representative bulk sampling of suspected hazardous materials to supplement observations at the Site.
- Submit the bulk samples collected to an accredited lab, under chain of custody protocol, for analysis.
- Provide a report outlining our findings and provide recommendations regarding the removal of the identified substances in accordance with planned remediation activities at the Site building.

3.0 REGULATIONS AND GUIDELINES

3.1 Asbestos

The regulations, guidelines and standards relevant to hazardous building materials include the Manitoba Workplace Health and Safety Regulation (M.R. 217/2006), the Manitoba guidance document entitled *The Guide for Asbestos Management* (November 2020), and the Manitoba Dangerous Goods Handling and Transportation Act.

Part 36 of M.R. 217/2006 prescribes airborne occupational exposure limits to chemical and biological substances based on Threshold Limit Values (TLV's) established by the American Conference of Governmental Industrial Hygienists (ACGIH). The TLVs for a contaminant represents conditions to which it is believed that nearly all workers may be exposed, day after day, over a working lifetime, without adverse health effects.

Part 37 of M.R. 217/2006 prescribes the overall requirements of a building owner or operator with respect to asbestos-containing materials in the workplace, as well as responsibilities prior to renovation or demolition of all or part of a workplace.

3.2 Lead

Lead is regulated under M.R. 217/2006, Parts 36 and 33, among others. Generally, removal of lead-containing paint is not required unless work performed on lead-containing materials is likely to produce airborne lead dust or fumes (e.g. during welding, torch cutting, sanding and sandblasting). If these operations are likely to occur during building renovation or alteration, it is recommended that the removal of lead-containing paint be carried out in accordance with M.R. 217/2006; Section 33.3, which states:

An employer must ensure that the demolition work is ... conducted in such a way as to ensure that, so far as is reasonably practicable, workers and other persons are not exposed to risks to their safety and health in connection with the demolition work.

Lead was used as a pigment and drying agent in alkyd oil-based paints. The Surface Coating Materials Regulations (SOR/2005-109) made under the Canada Consumer Product Safety Act restricts the lead content of paints and other liquid coatings on new furniture, household products, children's products, industrial surfaces and exterior and interior surfaces to 90 mg/kg by weight.

The Canadian Paint and Coatings Association (CPCA), the national trade association for Canada's paint manufacturers recommended that the Canadian paint industry voluntarily stop using any lead compounds in consumer paints by the end of 1990. Over the years, the amount of lead in paint has continued to decrease, due to the co-operative efforts of government and industry.

Similarly, lead and other heavy metals were commonly used in ceramic tile glaze, and for decorative finishing on other types of glassware.

M.R.217/2006 currently does not prescribe a defining threshold for a quantitative classification of lead-based paint. As such, TEC considers any paint with a detectable presence over 90 mg/kg of lead to be lead-containing paint, and abrasive techniques should be avoided. However, paints with less than 5,000 mg/kg of lead are generally considered safe to handle with general demolition or hand tools and wet handling techniques.

4.0 METHODOLOGY

The surveyor investigated the Site for suspected hazardous materials. The survey was conducted in such a fashion to limit damage where possible, as such hidden spaces such as ceiling or wall cavities were assessed only where access was available.

The select renovation areas were visually inspected to confirm the locations of suspect ACMs, lead paint and other hazardous materials. Where necessary, bulk samples were collected of materials for confirmation purposes.

Homogeneous materials sampling was utilized during the investigation. Specifically, bulk material sampling was completed on homogeneous materials that are uniform in colour, texture, and installation or construction date.

5.0 RESULTS AND OBSERVATIONS

5.1 Asbestos

Results of the analysis for suspected asbestos-containing materials are provided in Table 1: Analytical Results of ACM Samples and previously confirmed asbestos-containing materials are provided in Table 2: Previously Confirmed Asbestos-Containing Materials Present within 380 William Avenue. Select photographs have been included in **Appendix C – Select Site Photographs**. Full laboratory analytical results have been included in **Appendix A – Laboratory Certificate of Analysis – Asbestos.**

TABLE 1: Analytical Results of Bulk ACM Samples Collected within 380 William Avenue

SAMPLE NUMBER	SAMPLE DESCRIPTION	ASBESTOS CONTENT
380-1	Water Meter Room – Parging Cement Fitting	None Detected
380-2	Water Meter Room – Parging Cement Fitting	None Detected
380-3	Hydro Room Ceiling – Drywall Joint Compound	None Detected
380-4	Boiler Room Ceiling – Drywall Joint Compound	None Detected
380-5	Boiler Room – Hot Water Tank Parging Cement Fitting	None Detected
380-6	Boiler Room Flooring – Levelling Compound	None Detected
380-7	Boiler Room Flooring – Levelling Compound	None Detected
380-8	Corridor Flooring Between Hydro Room and Area C – Levelling Compound	None Detected
380-9	**Boiler Room Under Air Handling Unit – 9"x9" Vinyl Floor Tile**	**2% Chrysotile Asbestos**
380-10	Main Floor North Area – 9"x9" Vinyl Floor Tile	None Detected
380-11	Main Floor Mezzanine – 9"x9" Vinyl Floor Tile	None Detected
380-12	Main Floor South Area – 9"x9" Tan Vinyl Floor Tile	None Detected
380-13	1'x1' Ceiling Tile	None Detected
380-14	1'x1' Ceiling Tile	None Detected
380-15	1'x1' Ceiling Tile	None Detected
380-16	East Exterior – Cementitious Foundation Board	None Detected

SAMPLE NUMBER	SAMPLE DESCRIPTION	ASBESTOS CONTENT
380-17	North Exterior – Cementitious Foundation Board	None Detected
380-18	West Exterior – Cementitious Foundation Board	None Detected

TABLE 2: Previously Confirmed Asbestos-Containing Materials within 380 William Avenue

MATERIAL DESCRIPTION AND LOCATION	ASBESTOS CONTENT
Parging Cement Fitting – Area E Inside South Wall	80%
Heating and AC Room – Red Duct Mastic	1-5%
East Washroom – Black Duct Mastic	1-5%
Main Floor Drywall Partition Wall – Drywall Joint Compound	1-5%
Area G – 12"x12" Vinyl Floor Tile on Stair Treads	5%
Area G – 12"x12" Grey Vinyl Floor Tile	3%
Area G – 12"x12" Green Vinyl Floor Tile	3%
Area I – 9"x9" Beige and Red Vinyl Floor Tiles	5%
Area I – 12"x12" Grey Vinyl Floor Tiles	3%
2nd Floor Coffee Room – 9"x9" Red Vinyl Floor Tiles	2-10%
2nd Floor Coffee Room – Vinyl Floor Tile Mastic	2%
Mastic on East Roof Parapet	15%
Mastic on South Roof Parapet	10%
Insulation on Buried Pipe at South End of the Property	50-75%

Based on the analytical results presented in the above tables and Appendix A, as well as visual assessments during the Site visit, the following observations can be made with regards to the ACMs found within the Site area:

Wall and Ceiling Finishes

Walls and ceilings throughout the Site were noted to be smooth plaster. Previous samples of this material (22 samples) were found to contain no detectable levels of asbestos.

A scratch coat was also present on plaster in some areas of the site and (4 samples) was found to contain no detectable levels of asbestos.

Drywall was noted in the hydro room and boiler room in the basement of the Site. Previous samples (2 samples) and samples collected during the Gap Analysis (samples 380-3 and 380-4) were found to contain no detectable levels of asbestos.

Drywall was also present on the main floor as a partition wall dividing the north and south of the building. Previous samples of the drywall joint compound on this wall (3 samples) **were found to contain 1-5% asbestos.**

A drop ceiling within the developing film room on the second floor was noted to be newer non-suspect 2'x4' ceiling tiles in a drop ceiling.

A 1'x1' ceiling tile was present on multiple ceilings on the main and second floors (samples 380-13, 380-14 and 380-15) was found to contain no detectable levels of asbestos.

Flooring

Flooring throughout a majority of the basement was concrete or concrete with a leveller, with visual evidence that floor tiles had been previously removed. Samples of the levelling compound (samples 380-6, 380-7 and 380-8) were found to contain no detectable levels of asbestos, which is consistent with previous sample results (1 sample).

The 9"x9" tan vinyl floor tiles present throughout much of the main floor and main floor mezzanine (area G) were (samples 380-10, 380-11 and 380-12) found to contain no detectable levels of asbestos.

Multiple styles of floor tiles were present throughout the Site and based on previous sampling records combined with this gap analysis, the following styles of floor tiles are **known to contain asbestos**:

- Area G: 12"x12" Floor Tile on Stairs
- Area G: 12"x12" Grey Tile
- Area G: 12"x12" Green Tile
- Basement Boiler Room: 9"x9" Tile beneath Air Handler (sample 380-9)
- Area I: 12"x12" Grey Tile
- Area I: 9"x9" Beige and Red Tile (visually similar to beige and red tiles present in Areas A and D)
- 2nd Floor Coffee Room: 9"x9" Red Vinyl Floor Tiles and Mastic

MECHANICAL INSULATION

Previous sampling records show that a mixture of non-ACM parging cement fittings (14 samples) and asbestos-containing parging cement fittings (1 sample). Previous records also show that another sample of parging cement was confirmed to contain asbestos, but was confirmed to have been removed prior to this assessment.

In an effort to further delineate the extent of the asbestos-containing parging cement fittings, three additional samples of parging cement fittings were collected and (samples 380-1, 380-2 and 380-5), which were found to contain no detectable levels of asbestos.

Red duct mastic visibly present in the boiler room and developing film room has been **previously confirmed to contain asbestos.**

Black duct mastic within the east washroom was previously confirmed to contain asbestos, but was not observed during the Gap Assessment.

Previous samples collected of the boiler refractory (3 samples) were found to contain no detectable levels of asbestos.

The insulation material on a buried pipe at the south end of the property has been **previously confirmed to contain 50-75% asbestos.**

MISCELLANEOUS

On the exterior of the Site along the foundation a cementitious board was noted and (samples 380-16, 380-17 and 380-18) was found to contain no detectable levels of asbestos.

Due to the main floor window height, the caulking applied to the windows was unable to be sampled. This material should be presumed to contain asbestos until laboratory testing confirms otherwise.

ROOF

The roof had been previously replaced with newer non-suspect materials, however, the residual mastic remaining on the parapets has been **previously confirmed to contain 10-15% asbestos.**

5.2 Lead-Containing Materials

Results of the analysis for suspected lead-containing materials are provided below in Table 3: Analytical Results of Suspect Lead-Containing Materials and the previously confirmed lead-containing paint finishes are provided below in Table 4: Previously Confirmed Lead-Containing Paint Finishes Present within 380 William Avenue. Select photographs have been included in **Appendix C – Select Site Photographs**. Full laboratory analytical results have been included in **Appendix B – Laboratory Certificate of Analysis – Lead.**

TABLE 3: Analytical Results of Suspect Lead-Containing Paints Collected at 380 William Avenue

SAMPLE NUMBER	SAMPLE DESCRIPTION	LEAD CONTENT
380-LP-1	Grey Painted Concrete Flooring in Boiler Room	226 mg/kg

TABLE 4: Previously Confirmed Lead-Containing Paint Finishes Present within 380 William Avenue

FINISH DESCRIPTION	LEAD CONTENT
Basement Delivery Room Ceiling – White	3.82%
East Basement Trim – Green	4.22%
Second Floor Archives File East Wall – White	5.68%
Second Floor Open Area Ceiling – White	8.17%
Second Floor Open Area Ceiling – White	10.3%
Basement East Hallway Wall	0.29%
Basement West Archive Room (Room F)	0.236%
East Basement Wall – Green	0.176%
East Basement Wall – Beige	0.464%
Basement Room E South Wall – Pink	0.184%

Most of the paint finishes encountered throughout the Site had been previously assessed, with the noted exception of the grey paint applied to the concrete floor of the boiler room. As outlined above, TEC considers any paint with a detectable lead presence of 90 mg/kg (0.009%) or greater to be lead containing, while finishes greater than 5,000 mg/kg (greater than 0.5%) are considered lead based. As such, the grey paint applied to the boiler room floor is considered lead containing. Although the previously provided inventory does not list the finishes in the basement east hallway, basement west archive room, east basement walls and basement south room wall as lead containing, these finishes were found to have a detectable lead presence greater than 90mg/kg and should be considered to be lead-containing. Additionally, white walls, ceilings and green trim on Site are considered lead-based paints.

Lead-containing finishes may be safely handled using general dust control and leachate testing is not generally required. Additional precautions for lead-based paints, while avoiding abrasive removal, is recommended. Leachate testing may also apply for demolition waste finished with lead-based paints.

5.3 Mercury and Polychlorinated Biphenyls

Fluorescent light fixtures were observed throughout the assessed areas of the site, and most remained energized during the assessment. As most of the lights remained energized, a majority of the the light tubes and ballasts were not able to be assessed for the presence of mercury or PCBs. However, a stockpile of removed fluorescent light fixtures complete with light tubes and ballasts was located on the second floor. Light tubes were noted to be marked as "Hg" and are mercury containing. Ballasts which were able to be assessed were both PCB containing and non-PCB containing.

6.0 RECOMMENDATIONS

Non-friable asbestos-containing vinyl floor tiles may be safely removed following **Type 1** abatement procedures.

Non-friable asbestos-containing black and red mastic present on ducting may be safely removed following **Type 1** abatement procedures.

Non-friable asbestos-containing black mastic present on the roof parapets may be safely removed following **Type 1** abatement procedures.

Friable, asbestos-containing drywall joint compound applied to the main floor partition walls may be safely removed following **Type 2** abatement procedures where removal will impact less than one square meter of joint compound and will require less than three hours. If either of these parameters will be exceeded, procedures should be raised to **Type 3**.

Although there are multiple samples of the parging cement mechanical fittings which were found to contain no detectable levels of asbestos, because there are mixed results with asbestos-containing fittings, all parging cement fittings should be presumed to contain asbestos. Asbestos-containing mechanical insulation may be safely removed following **Glove Bag** procedures.

If the buried pipe at the South end of the property is accessible to be removed following **Glove Bag** procedures, the removal may proceed this way. However, if the pipe is not accessible, the insulation should be removed following **Type 3** procedures.

Caulking applied to the windows of the Site should be assessed if the windows will be impacted by the planned renovations on Site. Alternatively, caulking may be presumed to contain asbestos, and be safely handled following **Type 1** procedures.

Lead-containing and lead based finishes present on non-ACM materials may be safely removed using general dust control, including wet handling and hand demolition practices, provided that no abrasive removal methods are required such as cutting, grinding, sanding or drilling. If any abrasive demolition method or mechanical demolition methods will be required, the removal should occur inside of a negatively pressured enclosure, by workers wearing appropriate PPE such as Tyvek coveralls, disposable gloves and a minimum of half face respirators with P100 filters.

Where lead-containing or lead-based finishes are applied to asbestos-containing materials, removal may safely proceed under the more stringent asbestos precautions.

Lead leachate testing may be required to determine the disposal requirements of any lead-containing finish impacted by the demolition.

In general, whole demolition debris (i.e. that which consists of painted and non-painted components including wood, brick, cement, plaster, drywall, etc.) is not likely to exceed the TCLP testing for lead if it is handled as single,

bulk waste and disposed of all together. This is because of the small weight ratio of lead paint to total waste mass. Therefore, hazardous waste determination (i.e., TCLP Testing) is generally not required.

However, if lead-containing paints are stripped from the underlying building materials prior to disposal, they (i.e. loose paints or paint sludge) will require leachate testing to determine appropriate disposal precautions due to their concentrated nature.

Fluorescent light tubes and ballasts should be assessed for mercury and PCB content. Mercury containing light tubes and PCB containing ballasts may be safely disposed of at an appropriate hazardous waste disposal facility, such as Miller Environmental.

Abatement activities should only be undertaken by a qualified abatement contractor. All workers should be appropriately trained and fit-tested for the necessary personal protective equipment before being permitted to conduct asbestos removal activities.

7.0 LIMITATIONS

This report was prepared for the exclusive use of MCM Architects Inc. (the "Client"). This report is based on data and information collected during site visit conducted by Tesseract Environmental Consulting (TEC) and is based solely on site conditions encountered at the time of the site visit. Any use which a third party makes of this report, or any reliance on or discussion to be made based on it, are the sole responsibility of the third party.

The conclusions and recommendations contained in this report are based upon professional opinions with regard to the subject matter. These opinions are in accordance with currently accepted environmental assessment standards and practices applicable to this location and are subject to the following inherent limitations:

- The data and findings presented in this report are valid as of the date of the investigation. The passage of time, manifestation of latent conditions or occurrence of future events may warrant further exploration at the properties, analysis of the data, and re-evaluation of the findings, observations, and conclusions expressed in this report.
- Additional hazardous building materials not identified in this report may become evident during renovation or demolition activities. Should additional information become available, TEC requests that this information be brought to our attention so that we may re-assess the conclusions presented herein.
- The findings, observations and conclusions expressed by TEC in this report are not, and should not be considered, an opinion concerning compliance of any past or present owner or operator of the Site with any federal, provincial or local laws or regulations.
- TEC will not be responsible for any real or perceived decrease in a property value, its saleability or ability to gain financing through the reporting of information in this report.
- TEC report presents professional opinions and findings of a scientific and technical nature. While attempts were made to relate the data and findings to applicable environmental and occupational health & safety laws and regulations, the report shall not be construed to offer legal opinion or representations as to the requirements of, nor compliance with, environmental and occupational health & safety laws, rules, regulations or policies of federal, provincial, or local government agencies. Any use of this assessment report constitutes acceptance of the limits of TEC liability. TEC liability extends only to its client and not to other

parties who may obtain this assessment report. Issues raised by the report should be reviewed by appropriate legal counsel.

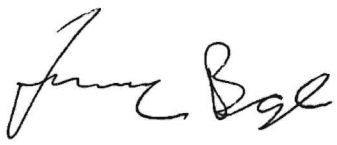
- In evaluating the Site conditions, TEC has relied in good faith on information provided by others. We accept no responsibility for any deficiency, misstatements or inaccuracies contained in this report as a result of omissions, misinterpretations or fraudulent acts of the persons involve.
- Any quantities of identified designated substances noted herein are estimated quantities for reporting purposes, and this report is limited in that regard. In the event that designated substances are scheduled to be removed in the future, it is solely the responsibility of the "abatement contractor" to confirm the exact quantities of designated substances to be removed, prior to their removal.

8.0 CLOSURE

If you have any questions regarding the information presented in this report, or require further assistance with environmental health and safety issues related to this, or any other Site, please feel free to contact the undersigned at (204) 250-0125. Thank you for the opportunity to offer our services.

TESSERACT ENVIRONMENTAL CONSULTING INC.

Prepared By:



Trevor Bage
Health and Safety Field Technologist

Reviewed By:

Ann McEachern, BSc.
OCCUPATIONAL HYGIENE CONSULTANT

Attachments:
Appendix A – Laboratory Certificates of Analysis – Asbestos
Appendix B – Laboratory Certificate of Analysis – Lead
Appendix C – Select Site Photographs
Appendix D – Previous Inventory

TESSERACT
ENVIRONMENTAL CONSULTING INC.

APPENDIX A

Laboratory Certificate of Analysis – Asbestos

CA Labs
Dedicated to Quality

Crisp Analytical, L.L.C.
1929 Old Denton Road
Carrollton, TX 75006
Phone 972-242-2754
Fax 972-242-2798

CA Labs, L.L.C.
12232 Industriplex, Suite 32
Baton Rouge, LA 70809
Phone 225-751-5632
Fax 225-751-5634

Materials Characterization - Bulk Asbestos Analysis

Laboratory Analysis Report - Polarized Light

Tesseract Environmental Consulting

179 McDermot Avenue Suite 111
Winnipeg, MB R3B 0S1

Customer Project: 23-MCM-0026 SPT-6000
Reference #: CAL23108756EC Date: 10/25/23

Analysis and Method

Summary of polarized light microscopy (PLM / Stereomicroscopy bulk asbestos analysis) using the methods described in 40CFR Part 763 Appendix E to Subpart E (Interim and EPA 600 / R-93 / 116 (Improved). The sample is first viewed with the aid of a stereomicroscope. Numerous liquid slide preparations are created for analysis under the polarized microscope where identifications and quantifications are preformed. Calibrated liquid refractive oils are used as liquid mouting medium. These oils are used for identification (dispersion staining). A calibrated visual estimation is reported, should any asbestiform mineral be present. Other techniques such as acid washing are used in conjugation with refractive oils for detection of smaller quantities of asbestos. All asbestos percentages are based on calibrated visual estimation traceable to NIST standards for regulated asbestos. Traceability to measurement and calibration is achieved by using known amounts and types of asbestos from standards where analyst and laboratory accuracy are measured. As little as 0.001% asbestos can be detected in favorable samples, while detection in unfavorable samples may approach the detection limit of 0.50% (well above the laboratory definition of trace).

Discussion

Vermiculite containing samples may contain trace amounts of actinolite/tremolite. When not detected by PLM, these samples should be analyzed using TEM methods and / or water separation techniques. Suspected actinolite/vermiculite presence will be indicated through the sample comment section of this report.

Fibrous talc containing samples may contain a regulated asbestos fiber known as anthophyllite. Under certain conditions the same fiber may actually contain both talc and anthophyllite (a phenomenon called intergrowth). Again, TEM detection methods are recommended. CA Labs PLM report comments will denote suspected amounts of asbestiform anthophyllite with talc, where further analysis is recommended.

Some samples (floor tiles, surfacings, etc.) may contain fibers too small to be detectable by PLM analysis and should be analyzed by TEM bulk protocols.

A "trace asbestos" will be reported if the analyst observes far less than 1% asbestos. CA Labs defines "trace asbestos" as a few fibers detected by the analyst in several preparations and will indicate as such under these circumstances.

Since allowable variation in quantification of samples close to 1% is high, <1% may be reported. Such results are ideal for point counting, and the technique is mandatory for friable samples (NESHAP, Nov. 1990 and clarification letter 8 May 1991) under 1% percent asbestos or "trace asbestos". **In order to make all initial PLM reports issued from CA Labs NESHAP compliant, all <1% asbestos results (except floor tiles) will be point counted at no additional charge.**

Qualifications

CA Labs is accredited by the National Voluntary Accreditation Program (NVLAP) for selected test methods for airborne fiber analysis (TEM), and for bulk asbestos fiber analysis (PLM). CA Labs is also accredited by AIHA LAP, LLC. in the PLM asbestos field of testing for Industrial Hygiene. All analysts have completed college courses or hold a degree in a natural science (geology, biology, or environmental science). Recognition by a state professional board in one these disciplines is preferred, but not required. Extensive in-house training programs are used to augment the educational background of the analyst. The Laboratory Director and Quality Manager have received supplemental McCrone Research training for asbestos identification. Analysis performed at Crisp Analytical Labs, LLC 1929 Old Denton Road Carrollton, TX 75006

Dallas NVLAP Lab Code 200349-0 TEM/PLM TCEQ# T104704513-15-3 TDH 30-0235
AIHA LAP, LLC Laboratory #102929

CA Labs
Dedicated to Quality

Crisp Analytical, L.L.C.
1929 Old Denton Road
Carrollton, TX 75006
Phone 972-242-2754
Fax 972-242-2798

CA Labs, L.L.C.
12232 Industriplex, Suite 32
Baton Rouge, LA 70809
Phone 225-751-5632
Fax 225-751-5634

Overview of Project Sample Material Containing Asbestos

Customer Project: 23-MCM-0026 SPT-6000 **CA Labs Project #:** CAL23108756EC

Laboratory Sample ID	Sample #	Layer #	Analysts Physical Description of Subsample	Asbestos type / calibrated visual estimate percent	List of Affected Building Material Types
97441	380-9	*380-9-1*	***VFT**/ tan floor tile*	***2% Chrysotile***	***tan floor tile***

Dallas NVLAP Lab Code 200349-0 TEM/PLM TCEQ# T104704513-15-3 TDH 30-0235
AIHA LAP, LLC Laboratory #102929

Glossary of abbreviations (non-asbestos fibers and non-fibrous minerals):

ca - carbonate
gypsum - gypsum
bi - binder
or - organic
ma - matrix
mi - mica
ve - vermiculite
ot - other
pe - perlite
qu - quartz
fg - fiberglass
mw - mineral wool
wo - wollastinite
ta - talc
sy - synthetic
ce - cellulose
br - brucite
ka - kaolin (clay)
pa - palygorskite (clay)

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Polarized Light Asbestiform Materials Characterization

Customer Info: **Attn:**
Tesseract Environmental Consulting
179 McDermot Avenue Suite 111
Winnipeg, MB R3B 0S1

Phone # 204-801-9358
Fax #

Customer Project:
23-MCM-0026 SPT-6000
Turnaround Time:
5 days

CA Labs Project #:
CAL23108756EC

Date: 10/25/2023
Samples Rec'd: 10/20/23 10:30 AM
Date Of Sampling: 10/13/2023
Purchase Order #: 23-MCM-0026 SPT-6000

Laboratory Sample ID	Sample #	Comment	Layer #	Analysts Physical Description of Subsample	Homogeneous (Y/N)	Asbestos type / calibrated visual estimate percent	Non-asbestos fiber type / percent	Non-fibrous type / percent
97433	380-1		*380-1-1*	***Parging**/ tan insulation*	*y*	***None Detected***	10% ce 10% fg	80% qu,ca,ma
97434	380-2		*380-2-1*	***Parging**/ tan insulation*	*y*	***None Detected***	10% ce 10% fg	80% qu,ca,ma
97435	380-3		*380-3-1*	***DJC**/ white compound*	*y*	***None Detected***		100% mi,ca
97435			*380-3-2*	*white drywall with brown paper*	*n*	***None Detected***	20% ce	80% qu,gy
97436	380-4		*380-4-1*	***DJC**/ white compound*	*y*	***None Detected***		100% mi,ca
97436			*380-4-2*	*white drywall with brown paper*	*n*	***None Detected***	20% ce	80% qu,gy
97437	380-5		*380-5-1*	***Parging**/ tan insulation*	*y*	***None Detected***	12% ce	88% qu,ca,ma

Dallas NVLAP Lab Code 200349-0 TEM/PLM TCEQ# T104704513-15-3 TDH 30-0235

AIHA LAP, LLC Laboratory #102929

Analysis Method: Interim (40CFR Part 763 Appendix E to Subpart E) / Improved (EPA-600 / R-93/116). *All samples received in good condition unless noted.*
Preparation Method: HCL acid washing for carbonate based samples, chemical reduction for organically bound components, oil immersion for identification of asbestos types by dispersion attaining / becke line method.

ca - carbonate	mi - mica	fg - fiberglass	ce - cellulose
gy - gypsum	ve - vermiculite	mw - mineral wool	br - brucite
bi - binder	ot - other	wo - wollastonite	ka - kaolin (clay)
or - organic	pe - perlite	ta - talc	pa - palygorskite (clay)
ma - matrix	qu - quartz	sy - synthetic	

Approved Signatories:

Julio Robles
Analyst

Technical Manager
Tanner Rasmussen

Senior Analyst
Julio Robles

1. Fire Damage significant fiber damage - reported percentages reflect unaltered fibers
2. Fire Damage no significant fiber damages effecting fibrous percentages
3. Actinolite in association with Vermiculite
4. Layer not analyzed - attached to previous positive layer and contamination is suspected
5. Not enough sample to analyze
6. Anthophyllite in association with Fibrous Talc
7. Contamination suspected from other building materials
8. Favorable scenario for water separation on vermiculite for possible analysis by another method
9. < 1% Result point counted positive
10. TEM analysis suggested

CA Labs
Dedicated to Quality

Crisp Analytical, L.L.C.
1929 Old Denton Road
Carrollton, TX 75006
Phone 972-242-2754
Fax 972-242-2798

CA Labs, L.L.C.
12232 Industriplex, Suite 32
Baton Rouge, LA 70809
Phone 225-751-5632
Fax 225-751-5634

Polarized Light Asbestiform Materials Characterization

Customer Info: **Attn:**
Tesseract Environmental Consulting
179 McDermot Avenue Suite 111
Winnipeg, MB R3B 0S1

Phone # 204-801-9358
Fax #

Customer Project:
23-MCM-0026 SPT-6000
Turnaround Time:
5 days

CA Labs Project #:
CAL23108756EC

Date: 10/25/2023
Samples Rec'd: 10/20/23 10:30 AM
Date Of Sampling: 10/13/2023
Purchase Order #: 23-MCM-0026 SPT-6000

Laboratory Sample ID	Sample #	Comment	Layer #	Analysts Physical Description of Subsample	Homogeneous (Y/N)	Asbestos type / calibrated visual estimate percent	Non-asbestos fiber type / percent	Non-fibrous type / percent
97438	380-6		*380-6-1*	***Leveling Compound**/ gray leveling compound*	*y*	***None Detected***		100% qu,ca
97439	380-7		*380-7-1*	***Leveling Compound**/ gray leveling compound*	*y*	***None Detected***		100% qu,ca
97440	380-8		*380-8-1*	***Leveling Compound**/ gray leveling compound*	*y*	***None Detected***		100% qu,ca
97441	380-9		*380-9-1*	***VFT**/ tan floor tile*	*y*	***2% Chrysotile***		98% qu,ca
97441			*380-9-2*	*black mastic*	*y*	***None Detected***		100% gy,bi
97442	380-10		*380-10-1*	***VFT**/ tan linoleum with black backing*	*y*	***None Detected***	25% ce	75% gy,ma
97443	380-11		*380-11-1*	***VFT**/ tan linoleum with black backing*	*y*	***None Detected***	25% ce	75% gy,ma

Dallas NVLAP Lab Code 200349-0 TEM/PLM *TCEQ# T104704513-15-3* *TDH 30-0235*

AIHA LAP, LLC Laboratory #102929

Analysis Method: Interim (40CFR Part 763 Appendix E to Subpart E) / Improved (EPA-600 / R-93/116). *All samples received in good condition unless noted.*
Preparation Method: HCL acid washing for carbonate based samples, chemical reduction for organically bound components, oil immersion for identification of asbestos types by dispersion attaining / becke line method.

ca - carbonate	mi - mica	fg - fiberglass	ce - cellulose
gy - gypsum	ve - vermiculite	mw - mineral wool	br - brucite
bi - binder	ot - other	wo - wollastonite	ka - kaolin (clay)
or - organic	pe - perlite	ta - talc	pa - palygorskite (clay)
ma - matrix	qu - quartz	sy - synthetic	

Approved Signatories:

Julio Robles
Analyst

Technical Manager
Tanner Rasmussen

Senior Analyst
Julio Robles

1. Fire Damage significant fiber damage - reported percentages reflect unaltered fibers
2. Fire Damage no significant fiber damages effecting fibrous percentages
3. Actinolite in association with Vermiculite
4. Layer not analyzed - attached to previous positive layer and contamination is suspected
5. Not enough sample to analyze
6. Anthophyllite in association with Fibrous Talc
7. Contamination suspected from other building materials
8. Favorable scenario for water separation on vermiculite for possible analysis by another method
9. < 1% Result point counted positive
10. TEM analysis suggested

CA Labs
Dedicated to Quality

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1929 Old Denton Road
Carrollton, TX 75006
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Polarized Light Asbestiform Materials Characterization

Customer Info: **Attn:**
Tesseract Environmental Consulting
179 McDermot Avenue Suite 111
Winnipeg, MB R3B 0S1

Phone # 204-801-9358
Fax #

Customer Project:
23-MCM-0026 SPT-6000
Turnaround Time:
5 days

CA Labs Project #:
CAL23108756EC

Date: 10/25/2023
Samples Rec'd: 10/20/23 10:30 AM
Date Of Sampling: 10/13/2023
Purchase Order #: 23-MCM-0026 SPT-6000

Laboratory Sample ID	Sample #	Comment	Layer #	Analysts Physical Description of Subsample	Homogeneous (Y/N)	Asbestos type / calibrated visual estimate percent	Non-asbestos fiber type / percent	Non-fibrous type / percent
97444	380-12		*380-12-1*	***VFT**/ tan linoleum with black backing*	*y*	***None Detected***	25% ce	75% gy,ma
97445	380-13		*380-13-1*	***Ceiling Tile**/ white surfacing*	*y*	***None Detected***		100% qu,bi
97445			*380-13-2*	*brown ceiling tile*	*y*	***None Detected***	100% ce	
97446	380-14		*380-14-1*	***Ceiling Tile**/ white surfacing*	*y*	***None Detected***		100% gy,bi
97446			*380-14-2*	*brown ceiling tile*	*y*	***None Detected***	100% ce	
97447	380-15		*380-15-1*	***Ceiling Tile**/ white surfacing*	*y*	***None Detected***		100% qu,bi
97447			*380-15-2*	*brown ceiling tile*	*y*	***None Detected***	100% ce	

Dallas NVLAP Lab Code 200349-0 TEM/PLM TCEQ# T104704513-15-3 TDH 30-0235

AIHA LAP, LLC Laboratory #102929

Analysis Method: Interim (40CFR Part 763 Appendix E to Subpart E) / Improved (EPA-600 / R-93/116). *All samples received in good condition unless noted.*
Preparation Method: HCL acid washing for carbonate based samples, chemical reduction for organically bound components, oil immersion for identification of asbestos types by dispersion attaining / becke line method.

ca - carbonate	mi - mica	fg - fiberglass	ce - cellulose
gy - gypsum	ve - vermiculite	mw - mineral wool	br - brucite
bi - binder	ot - other	wo - wollastonite	ka - kaolin (clay)
or - organic	pe - perlite	ta - talc	pa - palygorskite (clay)
ma - matrix	qu - quartz	sy - synthetic	

Approved Signatories:

Julio Robles
Analyst

Technical Manager
Tanner Rasmussen

Senior Analyst
Julio Robles

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7. Contamination suspected from other building materials
8. Favorable scenario for water separation on vermiculite for possible analysis by another method
9. < 1% Result point counted positive
10. TEM analysis suggested

CA Labs
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1929 Old Denton Road
Carrollton, TX 75006
Phone 972-242-2754
Fax 972-242-2798

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Polarized Light Asbestiform Materials Characterization

Customer Info: **Attn:**
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179 McDermot Avenue Suite 111
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Phone # 204-801-9358
Fax #

Customer Project:
23-MCM-0026 SPT-6000
Turnaround Time:
5 days

CA Labs Project #:
CAL23108756EC

Date: 10/25/2023
Samples Rec'd: 10/20/23 10:30 AM
Date Of Sampling: 10/13/2023
Purchase Order #: 23-MCM-0026 SPT-6000

Laboratory Sample ID	Sample #	Comment	Layer #	Analysts Physical Description of Subsample	Homogeneous (Y/N)	Asbestos type / calibrated visual estimate percent	Non-asbestos fiber type / percent	Non-fibrous type / percent
97448	380-16		*380-16-1*	***Cementitious Board**/ gray mortar*	*y*	***None Detected***		100% qu,ca
97449	380-17		*380-17-1*	***Cementitious Board**/ gray mortar*	*y*	***None Detected***		100% qu,ca
97450	380-18		*380-18-1*	***Cementitious Board**/ gray mortar*	*y*	***None Detected***		100% qu,ca

Dallas NVLAP Lab Code 200349-0 TEM/PLM TCEQ# T104704513-15-3 TDH 30-0235

AIHA LAP, LLC Laboratory #102929

Analysis Method: Interim (40CFR Part 763 Appendix E to Subpart E) / Improved (EPA-600 / R-93/116). *All samples received in good condition unless noted.*
Preparation Method: HCL acid washing for carbonate based samples, chemical reduction for organically bound components, oil immersion for identification of asbestos types by dispersion attaining / becke line method.

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gy - gypsum	ve - vermiculite	mw - mineral wool	br - brucite
bi - binder	ot - other	wo - wollastonite	ka - kaolin (clay)
or - organic	pe - perlite	ta - talc	pa - palygorskite (clay)
ma - matrix	qu - quartz	sy - synthetic	

Approved Signatories:

Julio Robles
Analyst

Technical Manager
Tanner Rasmussen

Senior Analyst
Julio Robles

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6. Anthophyllite in association with Fibrous Talc
7. Contamination suspected from other building materials
8. Favorable scenario for water separation on vermiculite for possible analysis by another method
9. < 1% Result point counted positive
10. TEM analysis suggested

TESSERACT
ENVIRONMENTAL CONSULTING INC.

APPENDIX B

Laboratory Certificate of Analysis – Lead

CA Labs
Dedicated to Quality

Crisp Analytical, L.L.C.
1929 Old Denton Road
Carrollton, TX 75006
Phone 972-242-2754
Fax 972-242-2798

CA Labs, L.L.C.
12232 Industriplex, Suite 32
Baton Rouge, LA 70809
Phone 225-751-5632
Fax 225-751-5634

Atomic Absorption Lead Report

Analysis Method: Lead in Paint analyzed by Atomic Absorption (AA)/SW-846-7420;
This analysis is not covered by the scope of accreditation by NVLAP or AIHA.

Sample Prep Method: Samples are dissolved in nitric acid, extracted, and analyzed on a properly calibrated AA; Absorbency curve was calculated, bandwidth corrected, and wavelength at the time of the analysis was measured and recorded.

Client Information:
Tesseract Environmental Consulting
2-1115 Henderson Hwy
Winnipeg, MB R2G 1L4
Phone: (204) 801-9358
Fax: (204) 480-4348

Client Project:
23-MCM-0026 SPT-6000, 380 William- Lead Paint

Turnaround Time: 5 days
Attn:

CA Labs Project #:
CAL23108760AG

Date of Sampling: 10/13/23
Report Date: 10/27/23
Samples Received: 10/20/23 10:30AM
Purchase Order #: 23-MCM-0026 SPT-6000

Sample#		Sample Concentration: parts per million (ppm)	Weight Percent:
380-LP-1		226.00	0.0226
Lab Blank	< 1.00	----	----

Quality Control:
Duplicate: 1.0 **RPD**
Spike: 99.1 **% Recovery**

All samples received in good condition unless noted

NVLAP # 200349-0

TDH # 30-0235

Approved Signatories:

Oswaldo Bermudez
Analyst

Julio Robles
Senior Analyst

Tanner Rasmussen
Technical Manager

Notes:
The current guidelines for lead in paint from the Consumer Products Safety Council (CPSC) is 0.06% by weight; the Housing and Urban Development (HUD) guideline is 0.5% by weight.

Analysis performed at Crisp Analytical Labs, LLC 1929 Old Denton Road Carrollton, TX 75006; phone (972) 242-2754, fax (972) 242-2798.

CA Labs
Dedicated to Quality

Crisp Analytical, L.L.C.
1929 Old Denton Road
Carrollton, TX 75006
Phone 972-242-2754
Fax 972-242-2798

CA Labs, L.L.C.
12232 Industriplex, Suite 32
Baton Rouge, LA 70809
Phone 225-751-5632
Fax 225-751-5634

ATOMIC ABSORPTION
LEAD ANALYSIS
LABORATORY ANALYSIS REPORT

Tesseract Environmental Consulting
2-1115 Henderson Hwy
Winnipeg, MB R2G 1L4

Reference number: CAL23108760AG

LABORATORY ANALYSIS:

Summary of lead analysis by atomic absorption in all relevant media using the method described in SW-846-7420. All analysts have received the necessary in-house and extramural training to perform analysis of samples for the presence of lead. A duplicate analysis is performed on greater than ten percent of all samples. A spiked concentration sample is analyzed with each sample group for instrument calibration. All analysts are required to participate in quality control analysis rounds. Instrument calibrations are performed on a daily, weekly, and monthly basis.

CA Labs is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) for selected test methods for airborne fiber analysis (TEM) and by the USEPA for analysis of asbestos in drinking water. CA Labs is accredited by the American Industrial Hygiene Association (AIHA LAP, LLC) PLM, TEM and PCM Asbestos fields of testing for industrial hygiene. This analysis is not covered by the scope of accreditation by NVLAP. This method is not covered by the AIHA accreditation for Industrial Hygiene.

METHOD:

The procedure for paint chip analysis follows AOAC5.009(974.02) and SW-846-7420. The analysis of soil, wipes, and wastewater for the presence of lead is also referenced by SW-846-7420. Methodology for the analysis of lead in air samples follows NIOSH Method 7082.

Analysis performed at Crisp Analytical Labs, L.L.C. 1929 Old Denton Road Carrollton, TX 75006: phone (972) 242-2754; fax (972) 242-2798.

TESSERACT
ENVIRONMENTAL CONSULTING INC.

APPENDIX C

Select Site Photographs

Photo 1: 380 William Avenue in Winnipeg, Manitoba.

Photo 2: Previously confirmed red/brown mastic in the boiler room and film developing room.

Photo 3: Non-ACM levelling compound on the concrete flooring in the boiler room, however the vinyl floor tiles beneath the air handler are asbestos-containing.

Photo 4: Previously confirmed asbestos-containing red and beige vinyl floor tiles.

Photo 5: No asbestos detected in the 9"x9" vinyl floor tiles present through most of the main floor.

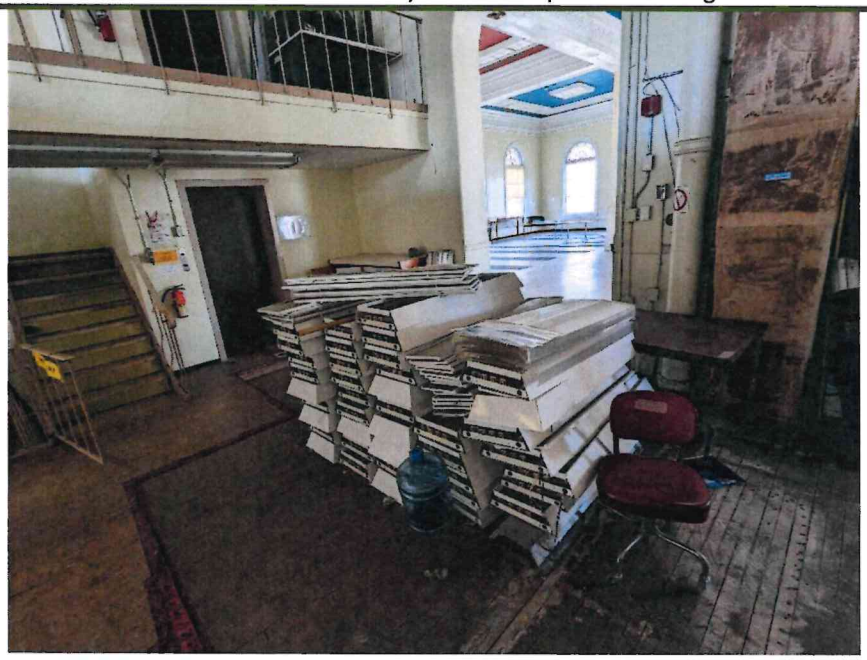

Photo 6: Stockpile of light fixtures and fluorescent bulbs on the second floor. Bulbs were marked as Hg, and observed ballasts were a mixture of non-PCB and PCB containing.

Photo 7: No asbestos-detected in the cementitious board on the foundation of the building.

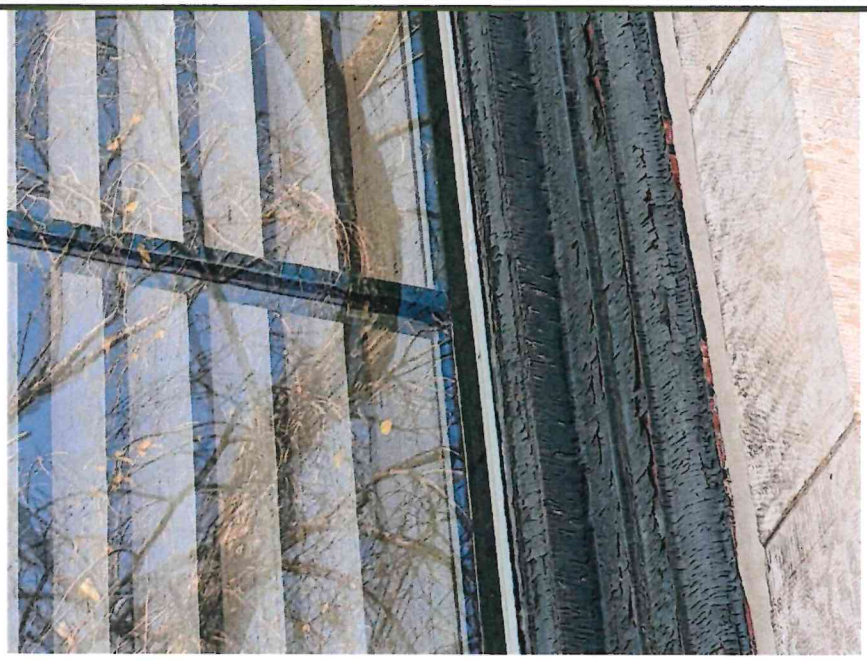

Photo 8: Caulking on the exterior of the windows was unable to be assessed, but should be presumed to contain asbestos until further analysis can be completed.

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ENVIRONMENTAL CONSULTING INC.

APPENDIX D

Previous Hazardous Materials Inventory

ASBESTOS INVENTORY CONTROL

Assets and Project Management
Municipal Accommodations Division
4th Floor - 185 King Street • Winnipeg, MB • R3B 1J1

Building Name:	Archives	**Inspection Date:**	December 20, 2022
Building Code:	HB-19	**Inspected By:**	Neal Richardson
Building Address:	380 William Avenue	**Construction Date:**	1903

NOTES:

1. Asbestos inspections and inventory updates are conducted annually.
2. There may be asbestos containing materials present that were not located during asbestos inspections.
3. Floor tile and sheet flooring installed before 1990 may contain asbestos and must be treated as an asbestos containing material.
4. Vermiculite insulation may contain pockets of asbestos. All vermiculite insulation must be treated as an asbestos containing material.
5. **For asbestos related inquiries, call Central Control at 986-2382**

HB-19

Material Location	Material Description	Drawing Label	Material Condition	Testing Status	Lab Report #	Date M/Y	Test %	Est. %
	Drywall Compound Contains Asbestos							
	Red Duct Mastic Contains Asbestos							
Basement								
Delivery Room	Pipe Fitting Insulation	PF	Good					
	9x9 Floor Tile	F9	**Removed'11**					
Janitor's Closet	Pipe Fitting Insulation	PF	Good					
Elevator Room	Plaster - Ceiling	PL	Good					
Area A	Pipe Fitting Insulation	PF	Good					
Corner Room at Area A	Pipe Fitting Insulation	PF	Good					
	9x9 Floor Tile	F9	Good					
Area B	Pipe Fitting Insulation	PF	Good					
Area C	Pipe Fitting Insulation	PF	Good					
Area D	Pipe Fitting Insulation	PF	Good					
	9x9 Floor Tile	F9	**Needs Repair**					
	Concrete Floor Topping (Under Floor Tile)		Good	**TESTED**	123144	Feb/13	0	
Area E	Pipe Fitting Insulation			**TESTED**	43654	Jan/07	0	
	9x9 Floor Tile - Under Shelving only	F9	**Removed'18**					
	Pipe Fitting Insulation - Inside South Wall	PF	**Needs Repair**	**TESTED**	212629	Dec/18	80	
	Plaster - Wall	PL	**Needs Repair**	**TESTED**	212629	Dec/18	0	
Area E1	9x9 Floor Tile	F9	**Removed'11**					

Material Location	Material Description	Drawing Label	Material Condition	Testing Status	Lab Report #	Date M/Y	Test %	Est. %
Area F	Pipe Fitting Insulation	PF	Good					
	Duct Insulation	DI	Good					
	12x12 Floor Tile	F12	Good					
	9x9 Floor Tile - Under Shelving Removed- Under Rolling Track Remains.	F9	Good					
North East Stair Landing	9x9 Floor Tile	F9	Good					
North West Beside Beam	Plaster	PL	Good	TESTED	91379	Sep/10	0	
	Pipe Fitting	PF	Good	TESTED	91379	Sep10	0	
Water Meter Room	Pipe Fitting Insulation	PF	Good					
Storage Room 1	Pipe Fitting Insulation	PF	Removed'13	TESTED	121154	Jan/13	3	
	Pipe Insulation	PI	Removed'13					3
Storage Under Stairs	Plaster - Ceiling	PL		TESTED	b72051	May/10	0	
	Mortar on Stair			TESTED	b72051	May/10	0	
	Granite Adhesive	MA	Good	TESTED	194108	Oct/11	0	
Men's Washroom	Pipe Fitting Insulation	PF	Good					
	9x9 Floor Tile	F9	Good					
	Wall Plaster	PL	Good	TESTED	43655	Jan/07	0	
	Ganular Insulation / Infill (Black/ White)		Needs Repair	TESTED	244938	Oct/'20	0	
Heating and AC Room	Pipe Fitting Insulation	PF	Removed	TESTED	43655	Jan/07	0	
	Pipe Fitting Insulation	PF	Good	TESTED	84854	Jan/07	0	
	Pipe Fitting Insulation	PF	Good	TESTED	84854	Jan/07	0	
	Pipe Fitting Insulation	PF	Good	TESTED	88723	Jul/10	0	
	Duct Insulation	DI		TESTED	84854	Jan/10	0	
	Boiler B-4 -Refractory Insulation (3 Samples)	BR	Good	TESTED	203260	Jun/18	0	
	Drywall Compound (SouthEast Wall)	DC	Good	TESTED	194108	Oct/17	0	
	Plaster	PL	Good	TESTED	58674	Jan/07	0	
	Duct Mastic Red	MA	Good	TESTED	b261674	Nov/'21	1-5	
	Pipe Fitting Insulation (2 Samples)	PF	Good	TESTED	258443	Jul/'21	0	
	Debris on Floor -West Wall			TESTED	258443	Jul/'21	0	
Boiler Rooms	Pipe Fitting Insulation (4 Samples)	PF	Needs Repair	TESTED	b228448	Mar/'20	0	
	Drywall Compound (1 Sample / bulkhead)	DC	Needs Repair	TESTED	265454	Dec/'21	0	
NE Corner	Stucco			TESTED	58674	Jun/08	0	
North Wall	Plaster - Walls - Sampled in 2 Areas	PL	Needs Repair	TESTED	194108	Oct/17	0	
Hydro Area	Pipe Fitting Insulation	PF	Good					

Material Location	Material Description	Drawing Label	Material Condition	Testing Status	Lab Report #	Date M/Y	Test %	Est. %
	Basement Lead Paint Samples							
East Hallway	*Wall*		Good	**TESTED**	*L72732*	Dec/18	.29	Neg
West Archive Room (Room F)	*Wall*		Good	**TESTED**	*L72732*	Dec/18	.236	Neg
Delivery Room	*Ceiling (White)*		Good	**TESTED**	*L72732*	Dec/18	3.82	Pos
East Basement	*Wall (Green)*		Good	**TESTED**	*L72732*	Dec/18	.176	Neg
East Basement	*Wall (Beige)*		Good	**TESTED**	*L72732*	Dec/18	.464	Neg
East Basement	*Positive for Lead (Green Trim)*		Good	**TESTED**	*L72732*	Dec/18	4.22	Pos
South Wall (Room E)	*Negative for Lead (Pink)*		Good	**TESTED**	*L72732*	Dec/18	.184	Neg
Main Floor								
Washroom(Location Not Clear)	Plaster (2 Samples)	PL		**Tested**	57744	Jun/08	0	
Storage Room	Pipe Fitting Insulation	PF	Good					
Library / Research	9x9 Floor Tile - Black Backing (3 Samples)	F9	**Needs Repair**	**TESTED**	230025	Nov/19	0	
	Glue -Tan/Red (3 Samples)			**TESTED**	230025	Nov/19	0	
	Floor Leveling Compound (3 Samples)			**TESTED**	230025	Nov/19	0	
	Wall Paper / Plaster Compound		Good	**TESTED**	194108	Oct/17	0	
	Wall Covering (3 Samples)			**TESTED**	b222911	Dec/19	0	
	Yellow Adhesive (3 Samples)			**TESTED**	b222911	Dec/19	0	
Office/Cubicles Archive Area C	Wall Paper & Mastic			**TESTED**	b261674	Nov/21	0	
	Sheet Flooring Patch	SH	**Needs Repair**	**TESTED**	b261674	Nov/21	0	
West Washroom	Pipe Fitting Insulation	PF	**Removed**					
Front Entrance	Floor Patch		Good	**TESTED**	92461	Oct/10	0	
	Pipe Fitting Insulation	PF	Good					
	Sheet Flooring (Tan/ Black)	FS	Good	**TESTED**	194108	Oct/17	0	
	9x9 Floor Tile	F9	**Needs Repair**	**TESTED**		Oct/17	0	
	Terazzo		**Needs Repair**	**TESTED**	244938	Oct/20	0	
North Stairwell Landing	Terazzo			**TESTED**	244938	Oct/'20	0	
East Washroom	Pipe Fitting Insulation		**Removed**					
	9x9 Floor Tile - Black Backing		Good	**TESTED**	65001	Mar/09	0	
	Plaster	PL	Good	**TESTED**	92461	Oct/10	0	
	Duct Mastic - Black	MA	Good	**TESTED**	b261674	Nov/21	1-5	
	Duct Mastic - Grey	MA	Good	**TESTED**	b261674	Nov/21	0	
Old Stairwell @ Men's W/C	Hardboard	HB	Good					

Material Location	Material Description	Drawing Label	Material Condition	Testing Status	Lab Report #	Date M/Y	Test %	Est. %
	Stucco - Walls	ST	Good	TESTED	92461	Oct/10	0	
Plaster Column	Plaster (2 Samples)	PL		TESTED	b222911	Dec/19	0	
	Scratch Coat (2 Samples)			TESTED	b222911	Dec/19	0	
Partition Wall	Drywall Compound (3 Samples)	DC	Good	TESTED	b222911	Dec/19	1-5	
Back Stairs - East	Steam Pipes		Removed					
Area G - Archive	Pipe Fitting Insulation		Removed/07	TESTED	43652	Apr/07	0	
	9x9 Floor Tile - Black Backing	F9	Good	TESTED	b73719	Jul/10	0	
	9x9 Floor Tiles - Black Backing (3 Samples)	F9	Needs Repair	TESTED	230025	Nov/19	0	
	Glue Tan/Red (3 Samples)			TESTED	230025	Nov/19	0	
	12x12 Floor Tile - Stair Treads	F12	Good	TESTED	84854	Apr/10	5	
	12x12 Floor Tile - Gray	F12	Good	TESTED	84854	Apr/10	3	
	12X12 Floor Tile - Green	F12	Good	TESTED	116724	Aug/12	3	
	Duct Insulation	DI	Good	TESTED	84854	Apr/10	0	
Safe	Brick		Good	TESTED	194108	Oct/17	0	
Main Floor - Mezzanine								
Area H	Pipe Fitting Insulation	PF		TESTED	84854	Apr/10	0	
	9x9 Floor Tile - grey - Black Backing	F9	Good	TESTED	194108	Aug/12	0	
Ceiling	Plaster (1 Sample)	PL		TESTED	b222911	Decf/19	0	
	Scratch Coat (1 Sample)	PL		TESTED	b222911	Dec/19	0	
Second Floor								
North Stairwell	Terazzo		Needs Repair	TESTED	244938	Oct/'20	0	
Developing Film Room	Pipe Fitting Insulation	PF	Good					
	Sheet Flooring	FS	Good	TESTED	101846	Jul/11	0	
	Mastic - Duct - Above Ceiling (Red/ Brown)	MA	Good					
Area I	Pipe Fitting Insulation	PF						
	9x9 Floor Tile - Beige and Red Tiles	F9	Good	TESTED	84854	Apr/10	5	
	12x12 Floor Tile - Grey	F12	Good	TESTED	116724	Aug/18	3	
Wall	Plaster (1 Sample)	PL	Needs Repair	TESTED	b222911	Dec/19	0	
	Scratch Coat (1 Sample) ***See Pinchin Report 234838.278***	PL	Good	TESTED	b222911	Dec/19	<0.1	0
Wall	Plaster	PL	Good	TESTED	b261750	Nov/'21	0	
Wall - Arch West	Plaster	PL	Good	TESTED	b261750	Nov/'21	0	
Column - Arch East	Plaster	PL	Good	TESTED	b261750	Nov/'21	0	
Wall - Second Flor SF	Plaster	PL	Good	TESTED	b261750	Nov/'21	0	
Wall - South	Plaster	PL	Good	TESTED	b261750	Nov/'21	0	

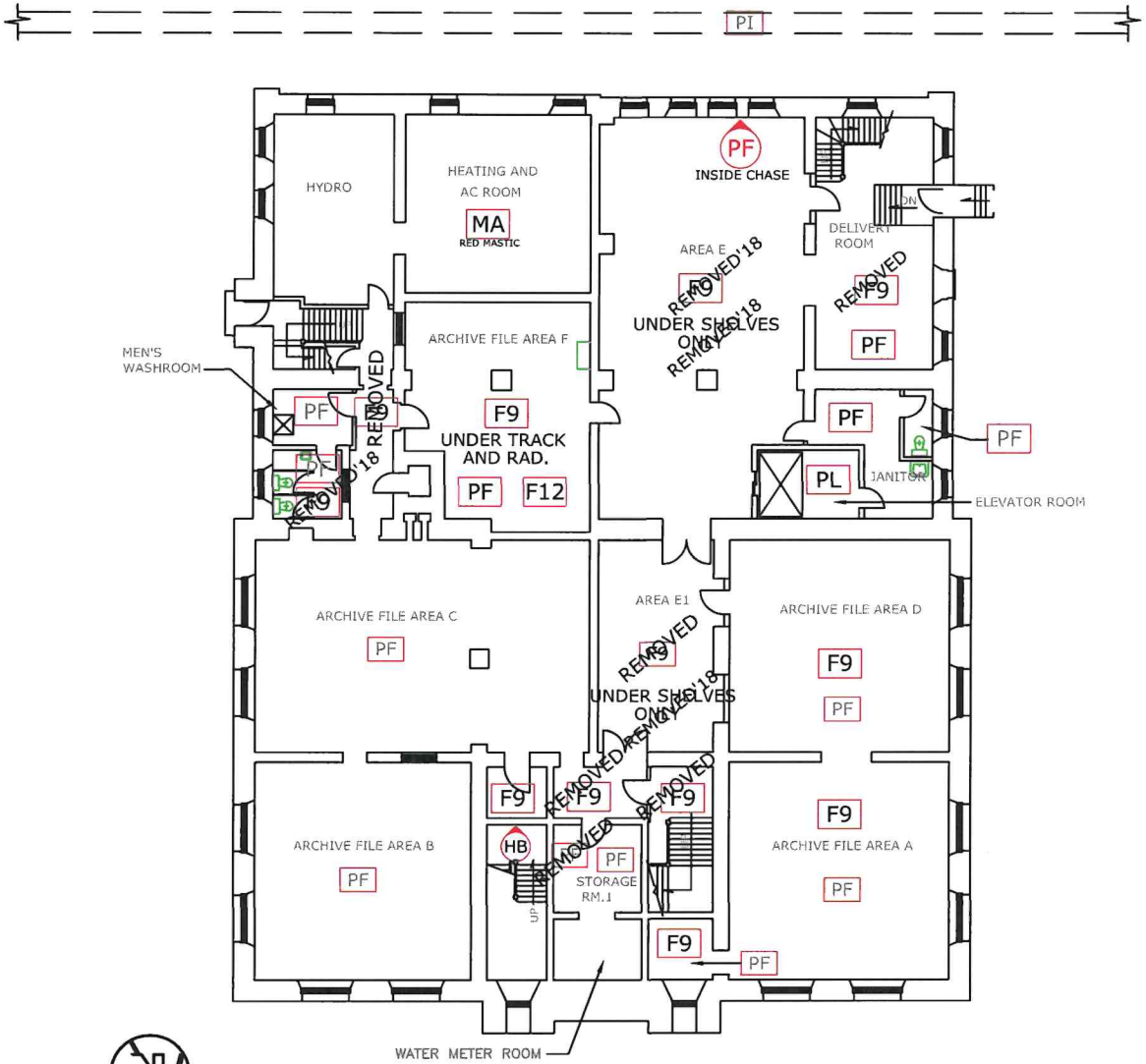
Material Location	Material Description	Drawing Label	Material Condition	Testing Status	Lab Report #	Date M/Y	Test %	Est. %
Wall - West Office Area	Plaster	PL	Good	TESTED	b261750	Nov/'21	0	
Under Floorboards - Central Archive Files Area	Debris Infill - Unknown Materials (2 Samples Taken)		Good	TESTED	b261768	Nov/'21	0	
	Second Floor Lead Samples							
Archive Files East	*Wall (White)*		**Needs Repair**	TESTED	*L78096*	Dec/19	5.68	
Open Area	*Ceiling (White)*		**Needs Repair**	TESTED	*L78096*	Dec/19	8.17	
Open Area	*Ceiling (White)*		**Needs Repair**	TESTED	*L78096*	Dec/19	10.3	
Archive Files East	9x9 Floor Tile (Removed by Others)	F9	**Removed**					
	12x12 Floor Tile (Removed by Others)	F12	**Removed**					
Open Area	Ceiling Beam			TESTED			0	
	9x9 Floor Tile Black Backing	F9	Good					0
Coffee Room	9x9 Floor Tile (red) - Under Carpet (tile mastic - 2%)	F9	Good	TESTED	84854	Apr/10	2-10	
Lounge	Sheet Flooring - Under Carpet	FS	Good	TESTED	116742	Aug/12	0	
	Fireplace Lining		Good	TESTED	194108	Oct/17	0	
Office @ Lounge Area	Mastic - Duct - Above Ceiling (Red/ Brown)	MA	Good					
Ceiling 2nd Floor	Plaster	PL	Good	TESTED	43653	Jan/07	0	
	Plaster	PL	Good	TESTED	64723	Feb/08	0	
Ceiling Under 2nd Flr Mezzanine	12x12 Ceiling Tile - Non-Asbestos							0
Archives Files East	Underlay		**Needs Repair**	TESTED	194108	Oct/'17	0	
Second Floor - Mezzanine								
Area J	Pipe Fitting Insulation	PF	Good	TESTED	101926	Aug/12	0	
	9x9 Floor Tile - Black Backing	F9	Good	TESTED		Jun/13	0	
Burried Pipe at South End of Property	Pipe Insulation	PI		TESTED		Sept/08	50-75	
Rooftop	Mortar		Good	TESTED	194108	Oct/17	0	
East Parapet Roof	Roof Mastic	MA	Good	TESTED	194108	Oct/17	15	
South Parapet Roof	Roof Mastic	MA	Good	TESTED	194108	Oct/17	10	

Material Location	Material Description	Drawing Label	Material Condition	Testing Status	Lab Report #	Date M/Y	Test %	Est. %

NOTES:

1. Asbestos inspections and inventory updates are conducted annually.
2. There may be asbestos containing materials present that were not located during asbestos inspections.
3. Floor tile and sheet flooring installed before 1990 may contain asbestos and must be treated as an asbestos containing material.
4. Vermiculite insulation may contain pockets of asbestos. All vermiculite insulation must be treated as an asbestos containing material.
5. **For asbestos related inquiries, call Central Control at 986-2382**

HB-19



BASEMENT PLAN

LEGEND

GENERAL LABELS ?? | ON CEILING ?? | ABOVE CEILING ?? | UNDER FLOORING ?? | WALL DETAIL ?? | ENCAPSULATED ASBESTOS

?? =

AF: ASBESTOS FABRIC	F9: 9X9 FLOOR TILE	SC: STIPPLE CEILING
BR: BOILER REFRACTORY	F12: 12X12 FLOOR TILE	SO: SPRAY ON
CA: CAULKING	HB: HARDBOARD	ST: STUCCO
C12: 12X12 CEILING TILE	MA: MASTIC	TI: TANK INSULATION
C24: 24X24 CEILING TILE	PF: PIPE FITTING INSULATION	TP: TRANSITE PIPE
C48: 24X48 CEILING TILE	PI: PIPE INSULATION	VE: VERMICULITE
DC: DRYWALL COMPOUND	PL: PLASTER	
DI: DUCT INSULATION	RD: ROOF DRAIN	
FS: SHEET FLOORING		

NOTES:
1. THERE MAY BE ASBESTOS CONTAINING MATERIALS PRESENT THAT WERE NOT LOCATED DURING BUILDING INSPECTIONS
2. REFER TO THE ASBESTOS INVENTORY SURVEY SHEET FOR MORE INFORMATION
3. DO NOT DISTURB ASBESTOS. FOR HANDLING PROCEDURES CALL CENTRAL CONTROL AT 986-2382

ASBESTOS LOCATIONS

BUILDING: Archives Building
HB - 19
380 William Avenue
Winnipeg, Manitoba

REVISED BY:	DATE:	SCALE:	SHEET #:
REM	DECEMBER 14, 2021	N.T.S.	1/3

CITY OF WINNIPEG
PLANNING, PROPERTY & DEVELOPMENT DEPARTMENT
MUNICIPAL ACCOMMODATIONS DIVISION
4th FLOOR - 185 KING STREET
WINNIPEG, MANITOBA R3B 1J1
PHONE: (204) 986-7266
FAX: (204) 986-7311
Winnipeg
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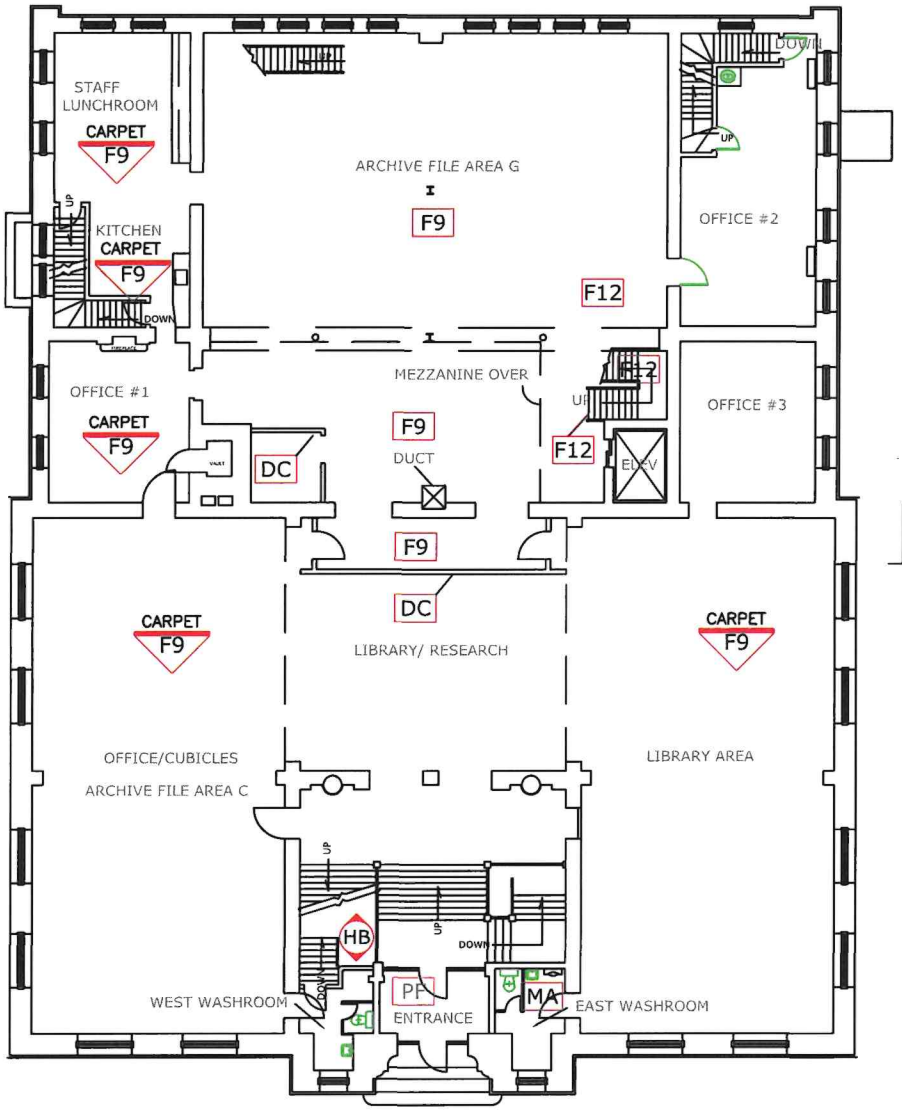
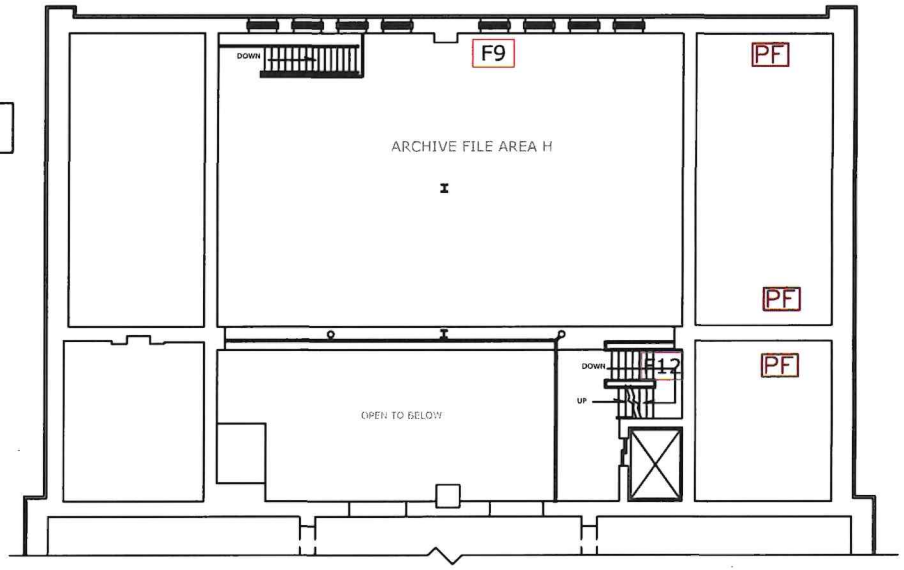


MAIN FLOOR PLAN



MAIN FLOOR MEZZANINE PLAN

LEGEND

GENERAL LABELS	ON CEILING	ABOVE CEILING	UNDER FLOORING	WALL DETAIL	ENCAPSULATED ASBESTOS
??	??	??	??	??	

?? =

AF: ASBESTOS FABRIC	F9: 9X9 FLOOR TILE	SC: STIPPLE CEILING
BR: BOILER REFRACTORY	F12: 12X12 FLOOR TILE	SO: SPRAY ON
CA: CAULKING	HB: HARDBOARD	ST: STUCCO
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DC: DRYWALL COMPOUND	PL: PLASTER	
DI: DUCT INSULATION	RD: ROOF DRAIN	
FS: SHEET FLOORING		

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ASBESTOS LOCATIONS

BUILDING: Archives Building
HB - 19
380 William Avenue
Winnipeg, Manitoba

REVISED BY:	DATE:	SCALE:	SHEET #:
REM	DECEMBER 15, 2021	N.T.S.	2/3

CITY OF WINNIPEG
PLANNING, PROPERTY & DEVELOPMENT DEPARTMENT
MUNICIPAL ACCOMMODATIONS DIVISION
4th FLOOR - 185 KING STREET
WINNIPEG, MANITOBA R3B 1J1
PHONE: (204) 986-7266
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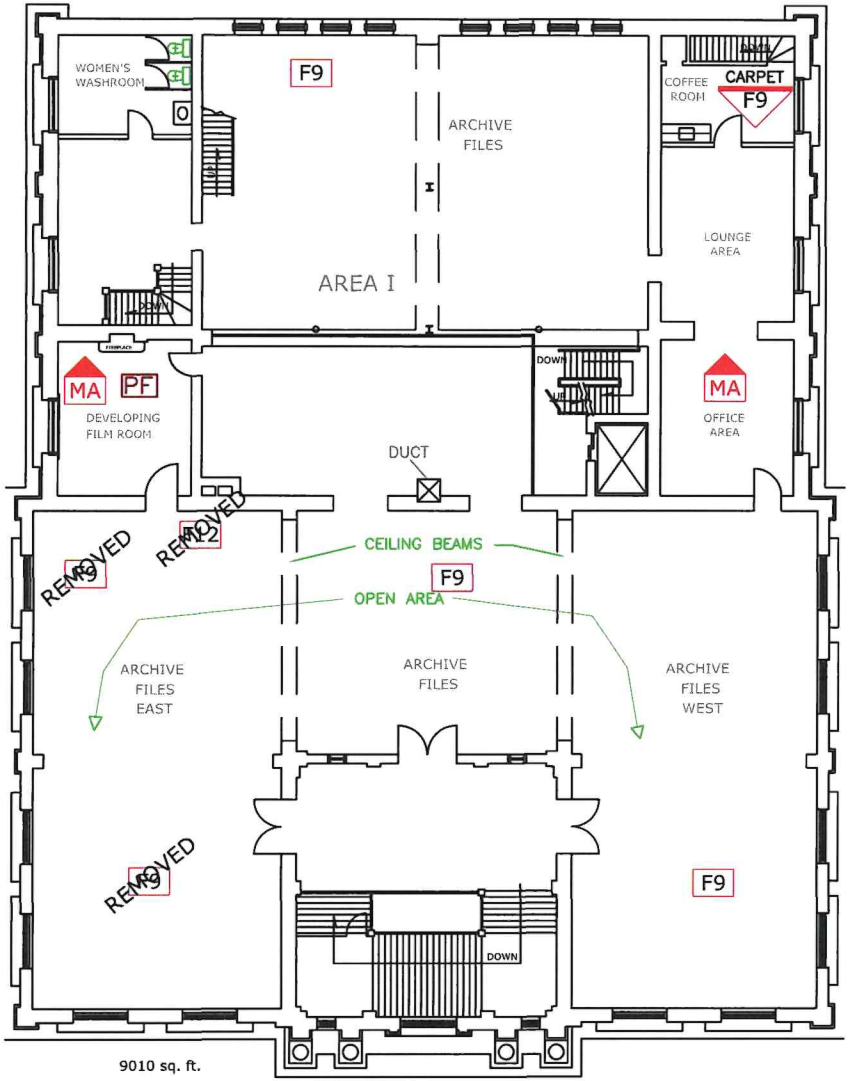
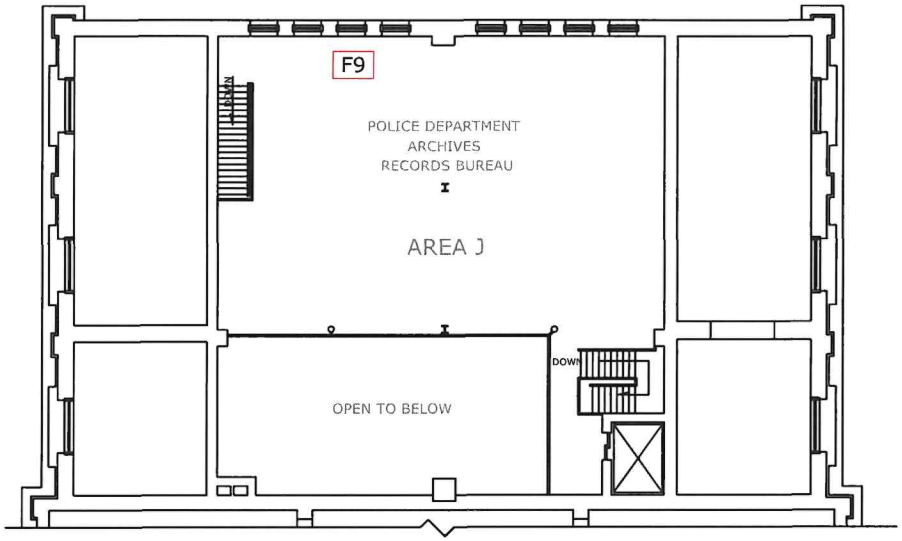


SECOND FLOOR PLAN



2ND FLOOR MEZZANINE PLAN

N

LEGEND

GENERAL LABELS	ON CEILING	ABOVE CEILING	UNDER FLOORING	WALL DETAIL	ENCAPSULATED ASBESTOS
??	??	??	??	??	

?? =

AF: ASBESTOS FABRIC	F9: 9X9 FLOOR TILE	SC: STIPPLE CEILING
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FS: SHEET FLOORING		

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ASBESTOS LOCATIONS

BUILDING: Archives Building
HB - 19
380 William Aveneu
Winnipeg, Manitoba

REVISED BY:	DATE:	SCALE:	SHEET #:
REM	OCTOBER 27, 2020	N.T.S.	3/3

CITY OF WINNIPEG
PLANNING, PROPERTY & DEVELOPMENT DEPARTMENT
MUNICIPAL ACCOMMODATIONS DIVISION
4th FLOOR - 185 KING STREET
WINNIPEG, MANITOBA R3B 1J1
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ASBESTOS INVENTORY CONTROL

Assets and Project Management
Municipal Accommodations Division
4th Floor - 185 King Street • Winnipeg, MB • R3B 1J1

Building Name:	Archives	**Inspection Date:**	July 12, 2024
Building Code:	HB-19	**Inspected By:**	Ryan Matthews / Tim MacDonald
Building Address:	380 William Avenue	**Construction Date:**	1903

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HB-19

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	Red Duct Mastic Contains Asbestos							
Basement								
Delivery Room	Pipe Fitting Insulation	PF	Good					
	9x9 Floor Tile	F9	**Removed'11**					
Janitor's Closet	Pipe Fitting Insulation	PF	Good					
Elevator Room	Plaster - Ceiling	PL	Good					
Area A	Pipe Fitting Insulation	PF	Good					
Corner Room at Area A	Pipe Fitting Insulation	PF	Good					
	9x9 Floor Tile	F9	Good					
Area B	Pipe Fitting Insulation	PF	Good					
Area C	Pipe Fitting Insulation	PF	Good					
Area D	Pipe Fitting Insulation	PF	Good					
	9x9 Floor Tile	F9	**Needs Repair**					
	Concrete Floor Topping (Under Floor Tile)		Good	**TESTED**	123144	Feb/13	0	
	Sheet flooring-oak table top	FS	Good	**TESTED**	b305155	Dec/'23	0	
Area E	Pipe Fitting Insulation			**TESTED**	43654	Jan/07	0	
	9x9 Floor Tile - Under Shelving only	F9	**Removed'18**					
	Pipe Fitting Insulation - Inside South Wall	PF	**Needs Repair**	**TESTED**	212629	Dec/18	80	
	Plaster - Wall	PL	**Needs Repair**	**TESTED**	212629	Dec/18	0	

Material Location	Material Description	Drawing Label	Material Condition	Testing Status	Lab Report #	Date M/Y	Test %	Est. %
Area E1	9x9 Floor Tile	F9	Removed'11					
Area F	Pipe Fitting Insulation	PF	Good					
	Duct Insulation	DI	Good					
	12x12 Floor Tile	F12	Good					
	9x9 Floor Tile - Under Shelving Removed- Under Rolling Track Remains.	F9	Good					
North East Stair Landing	9x9 Floor Tile	F9	Good					
North West Beside Beam	Plaster	PL	Good	TESTED	91379	Sep/10	0	
	Pipe Fitting	PF	Good	TESTED	91379	Sep10	0	
Water Meter Room	Pipe Fitting Insulation	PF	Good					
Storage Room 1	Pipe Fitting Insulation	PF	Removed'13	TESTED	121154	Jan/13	3	
	Pipe Insulation	PI	Removed'13					3
Storage Under Stairs	Plaster - Ceiling	PL		TESTED	b72051	May/10	0	
	Mortar on Stair			TESTED	b72051	May/10	0	
	Granite Adhesive	MA	Good	TESTED	194108	Oct/11	0	
Men's Washroom	Pipe Fitting Insulation	PF	Good					
	9x9 Floor Tile	F9	Good					
	Wall Plaster	PL	Good	TESTED	43655	Jan/07	0	
	Ganular Insulation / Infill (Black/ White)		Needs Repair	TESTED	244938	Oct/'20	0	
Heating and AC Room	Pipe Fitting Insulation	PF	Removed	TESTED	43655	Jan/07	0	
	Pipe Fitting Insulation	PF	Good	TESTED	84854	Jan/07	0	
	Pipe Fitting Insulation	PF	Good	TESTED	84854	Jan/07	0	
	Pipe Fitting Insulation	PF	Good	TESTED	88723	Jul/10	0	
	Duct Insulation	DI		TESTED	84854	Jan/10	0	
	Boiler B-4 -Refractory Insulation (3 Samples)	BR	Good	TESTED	203260	Jun/18	0	
	Drywall Compound (SouthEast Wall)	DC	Good	TESTED	194108	Oct/17	0	
	Plaster	PL	Good	TESTED	58674	Jan/07	0	
	Duct Mastic Red	MA	Good	TESTED	b261674	Nov/'21	1-5	
	Pipe Fitting Insulation (2 Samples)	PF	Good	TESTED	258443	Jul/'21	0	
	Debris on Floor -West Wall			TESTED	258443	Jul/'21	0	
Boiler Rooms	Pipe Fitting Insulation (4 Samples)	PF	Needs Repair	TESTED	b228448	Mar/'20	0	
	Drywall Compound (1 Sample / bulkhead)	DC	Needs Repair	TESTED	265454	Dec/'21	0	
NE Corner	Stucco			TESTED	58674	Jun/08	0	
North Wall	Plaster - Walls - Sampled in 2 Areas	PL	Needs Repair	TESTED	194108	Oct/17	0	

Material Location	Material Description	Drawing Label	Material Condition	Testing Status	Lab Report #	Date M/Y	Test %	Est. %
Hydro Area	Pipe Fitting Insulation	PF	Good					
	Basement Lead Paint Samples							
East Hallway	*Wall*		Good	**TESTED**	*L72732*	Dec/18	.29	Neg
West Archive Room (Room F)	*Wall*		Good	**TESTED**	*L72732*	Dec/18	.236	Neg
Delivery Room	*Ceiling (White)*		Good	**TESTED**	*L72732*	Dec/18	3.82	Pos
East Basement	*Wall (Green)*		Good	**TESTED**	*L72732*	Dec/18	.176	Neg
East Basement	*Wall (Beige)*		Good	**TESTED**	*L72732*	Dec/18	.464	Neg
East Basement	*Positive for Lead (Green Trim)*		Good	**TESTED**	*L72732*	Dec/18	4.22	Pos
South Wall (Room E)	*Negative for Lead (Pink)*		Good	**TESTED**	*L72732*	Dec/18	.184	Neg
Main Floor								
Washroom(Location Not Clear)	Plaster (2 Samples)	PL		**Tested**	57744	Jun/08	0	
Storage Room	Pipe Fitting Insulation	PF	Good					
Library / Research	9x9 Floor Tile - Black Backing (3 Samples)	F9	**Needs Repair**	**TESTED**	230025	Nov/19	0	
	Glue -Tan/Red (3 Samples)			**TESTED**	230025	Nov/19	0	
	Floor Leveling Compound (3 Samples)			**TESTED**	230025	Nov/19	0	
	Wall Paper / Plaster Compound		Good	**TESTED**	194108	Oct/17	0	
	Wall Covering (3 Samples)			**TESTED**	b222911	Dec/19	0	
	Yellow Adhesive (3 Samples)			**TESTED**	b222911	Dec/19	0	
Office/Cubicles Archive Area C	Wall Paper & Mastic			**TESTED**	b261674	Nov/21	0	
	Sheet Flooring Patch	SH	**Needs Repair**	**TESTED**	b261674	Nov/21	0	
West Washroom	Pipe Fitting Insulation	PF	**Removed**					
Front Entrance	Floor Patch		Good	**TESTED**	92461	Oct/10	0	
	Pipe Fitting Insulation	PF	Good					
	Sheet Flooring (Tan/ Black)	FS	Good	**TESTED**	194108	Oct/17	0	
	9x9 Floor Tile	F9	**Needs Repair**	**TESTED**		Oct/17	0	
	Terazzo		**Needs Repair**	**TESTED**	244938	Oct/20	0	
North Stairwell Landing	Terazzo			**TESTED**	244938	Oct/'20	0	
East Washroom	Pipe Fitting Insulation		**Removed**					
	9x9 Floor Tile - Black Backing		Good	**TESTED**	65001	Mar/09	0	
	Plaster	PL	Good	**TESTED**	92461	Oct/10	0	
	Duct Mastic - Black	MA	Good	**TESTED**	b261674	Nov/21	1-5	
	Duct Mastic - Grey	MA	Good	**TESTED**	b261674	Nov/21	0	

Material Location	Material Description	Drawing Label	Material Condition	Testing Status	Lab Report #	Date M/Y	Test %	Est. %
Old Stairwell @ Men's W/C	Hardboard	HB	Good					
	Stucco - Walls	ST	Good	TESTED	92461	Oct/10	0	
Plaster Column	Plaster (2 Samples)	PL		TESTED	b222911	Dec/19	0	
	Scratch Coat (2 Samples)			TESTED	b222911	Dec/19	0	
Partition Wall	Drywall Compound (3 Samples)	DC	Good	TESTED	b222911	Dec/19	1-5	
Back Stairs - East	Steam Pipes		**Removed**					
Area G - Archive	Pipe Fitting Insulation		**Removed/07**	TESTED	43652	Apr/07	0	
	9x9 Floor Tile - Black Backing	F9	Good	TESTED	b73719	Jul/10	0	
	9x9 Floor Tiles - Black Backing (3 Samples)	F9	**Needs Repair**	TESTED	230025	Nov/19	0	
	Glue Tan/Red (3 Samples)			TESTED	230025	Nov/19	0	
	12x12 Floor Tile - Stair Treads	F12	Good	TESTED	84854	Apr/10	5	
	12x12 Floor Tile - Gray	F12	Good	TESTED	84854	Apr/10	3	
	12X12 Floor Tile - Green	F12	Good	TESTED	116724	Aug/12	3	
	Duct Insulation	DI	Good	TESTED	84854	Apr/10	0	
Safe	Brick		Good	TESTED	194108	Oct/17	0	
Main Floor - Mezzanine								
Area H	Pipe Fitting Insulation	PF		TESTED	84854	Apr/10	0	
	9x9 Floor Tile - grey - Black Backing	F9	Good	TESTED	194108	Aug/12	0	
Ceiling	Plaster (1 Sample)	PL		TESTED	b222911	Decf/19	0	
	Scratch Coat (1 Sample)	PL		TESTED	b222911	Dec/19	0	
Second Floor								
Floor-Acoustic Dampner	Granular-Acoustic Dampning Material		Good	TESTED	b305155	Dec/'23	0	
North Stairwell	Terazzo		**Needs Repair**	TESTED	244938	Oct/'20	0	
Developing Film Room	Pipe Fitting Insulation	PF	Good					
	Sheet Flooring	FS	Good	TESTED	101846	Jul/11	0	
	Mastic - Duct - Above Ceiling (Red/ Brown)	MA	Good					
Area I	Pipe Fitting Insulation	PF						
	9x9 Floor Tile - Beige and Red Tiles	F9	Good	TESTED	84854	Apr/10	5	
	9x9 Floor Tile - Beige and Red Tiles	F9	**Needs Repair**	TESTED	b305155	Dec/'23	0	
	12x12 Floor Tile - Grey	F12	Good	TESTED	116724	Aug/18	3	
Wall	Plaster (1 Sample)	PL	**Needs Repair**	TESTED	b222911	Dec/19	0	
	Scratch Coat (1 Sample) ***See Pinchin Report 234838.278***	PL	Good	TESTED	b222911	Dec/19	<0.1	0
Wall	Plaster	PL	Good	TESTED	b261750	Nov/'21	0	

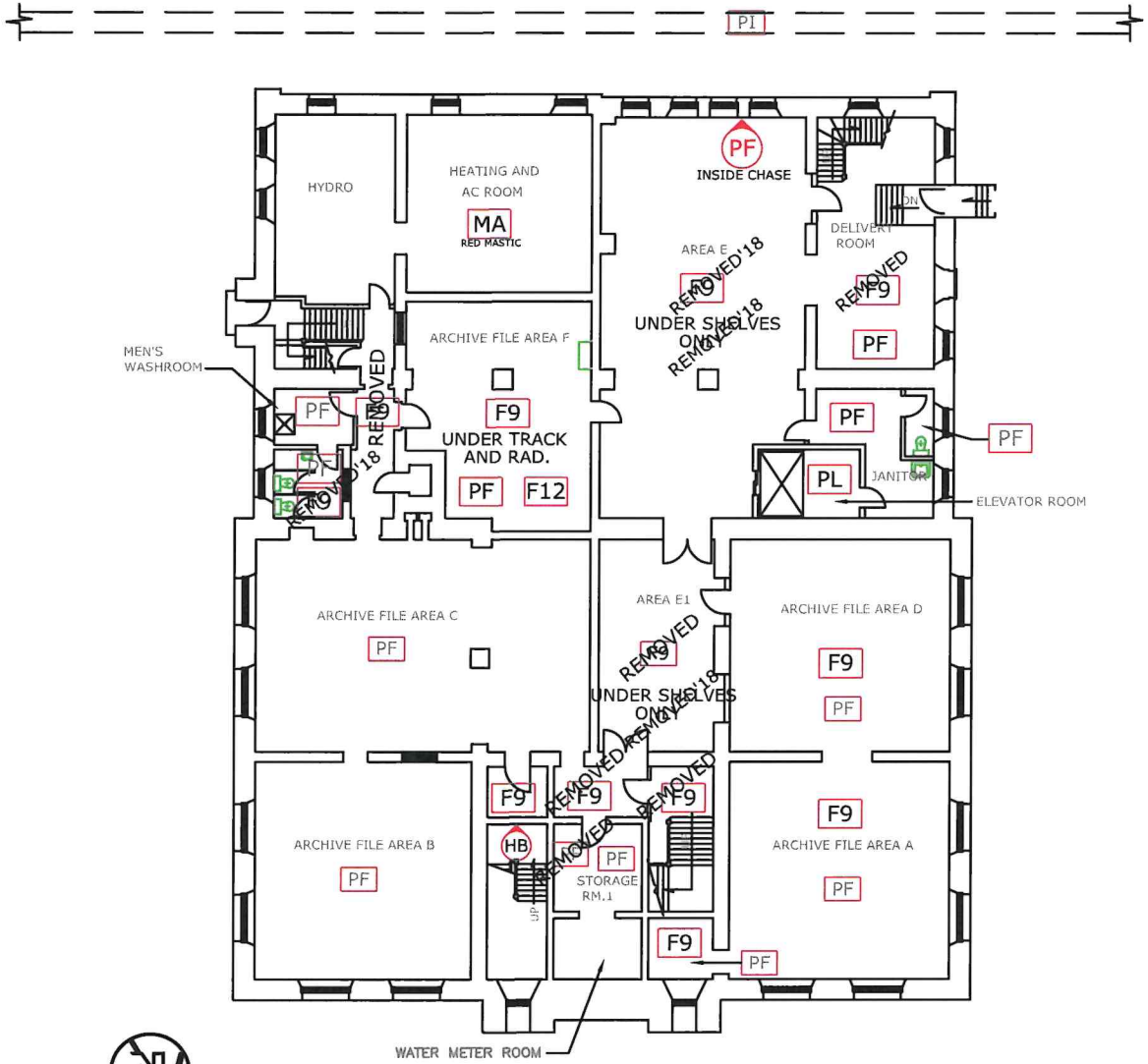
Material Location	Material Description	Drawing Label	Material Condition	Testing Status	Lab Report #	Date M/Y	Test %	Est. %
Wall - Arch West	Plaster	PL	Good	TESTED	b261750	Nov/'21	0	
Column - Arch East	Plaster	PL	Good	TESTED	b261750	Nov/'21	0	
Wall - Second Flor SF	Plaster	PL	Good	TESTED	b261750	Nov/'21	0	
Wall - South	Plaster	PL	Good	TESTED	b261750	Nov/'21	0	
Wall - West Office Area	Plaster	PL	Good	TESTED	b261750	Nov/'21	0	
Under Floorboards - Central Archive Files Area	Debris Infill - Unknown Materials (2 Samples Taken)		Good	TESTED	b261768	Nov/'21	0	
	Second Floor Lead Samples							
Archive Files East	*Wall (White)*		**Needs Repair**	TESTED	*L78096*	Dec/19	5.68	
Open Area	*Ceiling (White)*		**Needs Repair**	TESTED	*L78096*	Dec/19	8.17	
Open Area	*Ceiling (White)*		**Needs Repair**	TESTED	*L78096*	Dec/19	10.3	
Archive Files East	9x9 Floor Tile (Removed by Others)	F9	**Removed**					
	12x12 Floor Tile (Removed by Others)	F12	**Removed**					
East Stairway	Sheet Flooring	FS	Good	TESTED	b305155	Dec/'23	0	
Open Area	Ceiling Beam			TESTED			0	
	9x9 Floor Tile Black Backing	F9	Good					0
Coffee Room	9x9 Floor Tile (red) - Under Carpet (tile mastic - 2%)	F9	Good	TESTED	84854	Apr/10	2-10	
Lounge	Sheet Flooring - Under Carpet	FS	Good	TESTED	116742	Aug/12	0	
	Fireplace Lining		Good	TESTED	194108	Oct/17	0	
Office @ Lounge Area	Mastic - Duct - Above Ceiling (Red/ Brown)	MA	Good					
Ceiling 2nd Floor	Plaster	PL	Good	TESTED	43653	Jan/07	0	
	Plaster	PL	Good	TESTED	64723	Feb/08	0	
Ceiling Under 2nd Flr Mezzanine	12x12 Ceiling Tile - Non-Asbestos							0
Archives Files East	Underlay		**Needs Repair**	TESTED	194108	Oct/'17	0	
Second Floor - Mezzanine								
Area J	Pipe Fitting Insulation	PF	Good	TESTED	101926	Aug/12	0	
	9x9 Floor Tile - Black Backing	F9	Good	TESTED		Jun/13	0	
Burried Pipe at South End of Property	Pipe Insulation	PI		TESTED		Sept/08	50-75	
Rooftop	Mortar		Good	TESTED	194108	Oct/17	0	
East Parapet Roof	Roof Mastic	MA	Good	TESTED	194108	Oct/17	15	

Material Location	Material Description	Drawing Label	Material Condition	Testing Status	Lab Report #	Date M/Y	Test %	Est. %
South Parapet Roof	Roof Mastic	MA	Good	TESTED	194108	Oct/17	10	

NOTES:

1. Asbestos inspections and inventory updates are conducted annually.
2. There may be asbestos containing materials present that were not located during asbestos inspections.
3. Floor tile and sheet flooring installed before 1990 may contain asbestos and must be treated as an asbestos containing material.
4. Vermiculite insulation may contain pockets of asbestos. All vermiculite insulation must be treated as an asbestos containing material.
5. **For asbestos related inquiries, call Central Control at 986-2382**

HB-19



BASEMENT PLAN

LEGEND

GENERAL LABELS ?? | ON CEILING ?? | ABOVE CEILING ?? | UNDER FLOORING ?? | WALL DETAIL ?? | ENCAPSULATED ASBESTOS

?? =

- AF: ASBESTOS FABRIC
- BR: BOILER REFRACTORY
- CA: CAULKING
- C12: 12X12 CEILING TILE
- C24: 24X24 CEILING TILE
- C48: 24X48 CEILING TILE
- DC: DRYWALL COMPOUND
- DI: DUCT INSULATION
- FS: SHEET FLOORING
- F9: 9X9 FLOOR TILE
- F12: 12X12 FLOOR TILE
- HB: HARDBOARD
- MA: MASTIC
- PF: PIPE FITTING INSULATION
- PI: PIPE INSULATION
- PL: PLASTER
- RD: ROOF DRAIN
- SC: STIPPLE CEILING
- SO: SPRAY ON
- ST: STUCCO
- TI: TANK INSULATION
- TP: TRANSITE PIPE
- VE: VERMICULITE

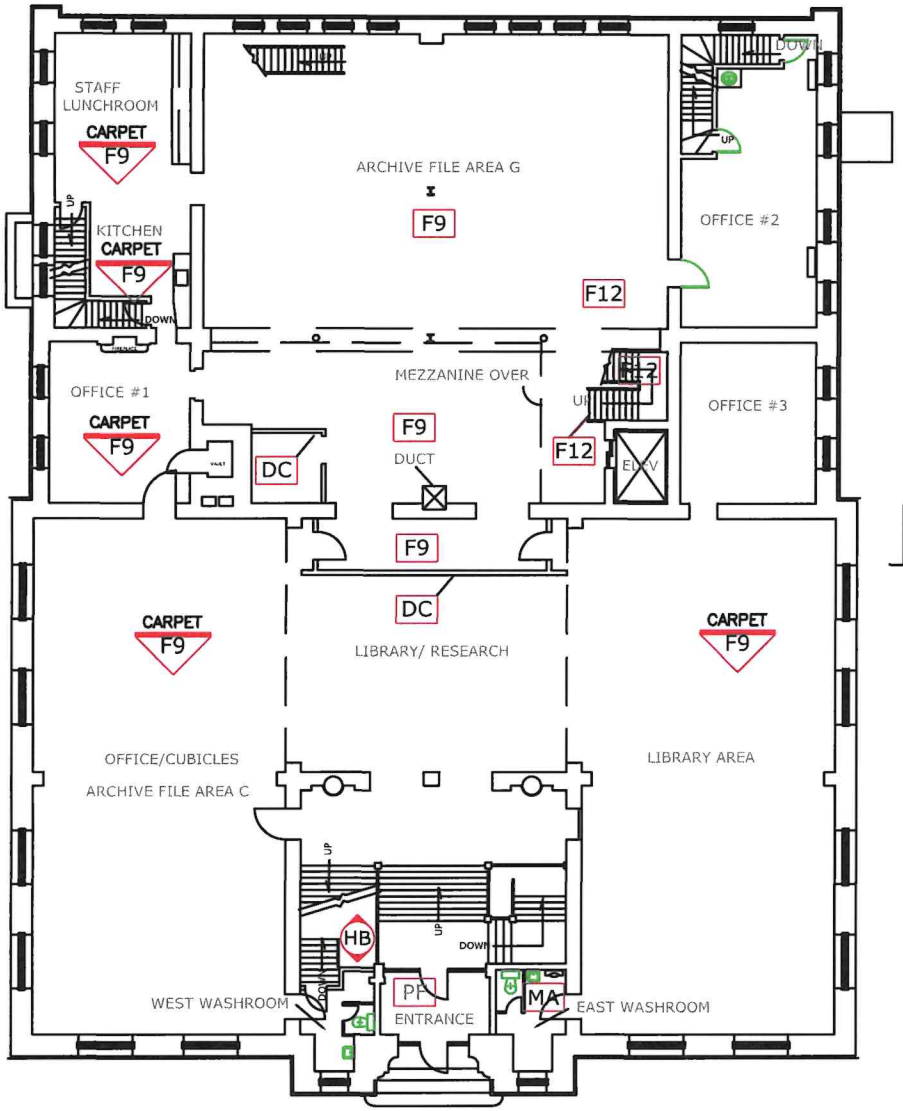
NOTES:
1. THERE MAY BE ASBESTOS CONTAINING MATERIALS PRESENT THAT WERE NOT LOCATED DURING BUILDING INSPECTIONS
2. REFER TO THE ASBESTOS INVENTORY SURVEY SHEET FOR MORE INFORMATION
3. DO NOT DISTURB ASBESTOS. FOR HANDLING PROCEDURES CALL CENTRAL CONTROL AT 986-2382

ASBESTOS LOCATIONS

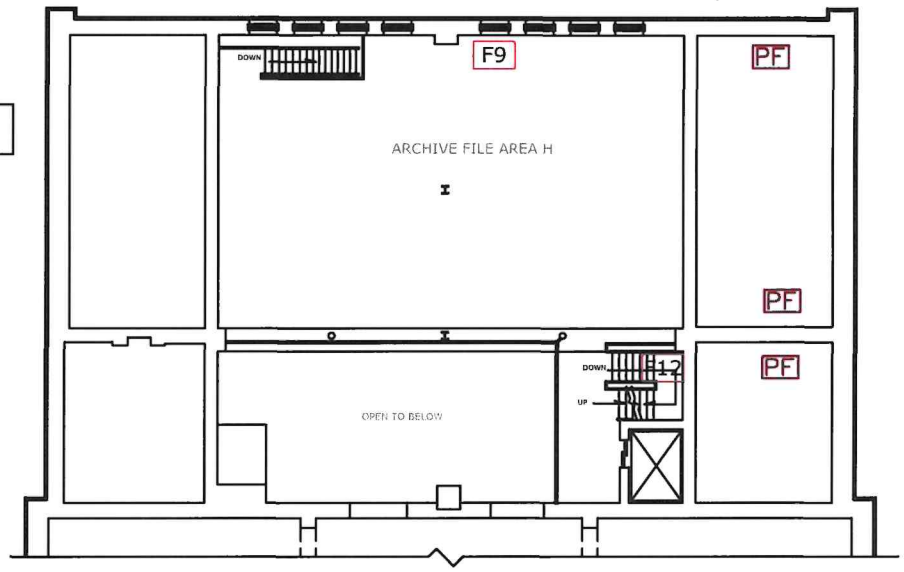
BUILDING: Archives Building
HB - 19
380 William Avenue
Winnipeg, Manitoba

REVISED BY:	DATE:	SCALE:	SHEET #:
REM	DECEMBER 14, 2021	N.T.S.	1/3

CITY OF WINNIPEG
PLANNING, PROPERTY & DEVELOPMENT DEPARTMENT
MUNICIPAL ACCOMMODATIONS DIVISION
4th FLOOR - 185 KING STREET
WINNIPEG, MANITOBA R3B 1J1
PHONE: (204) 986-7266
FAX: (204) 986-7311



MAIN FLOOR PLAN



MAIN FLOOR MEZZANINE PLAN

N

LEGEND

GENERAL LABELS	ON CEILING	ABOVE CEILING	UNDER FLOORING	WALL DETAIL	ENCAPSULATED ASBESTOS
??	??	??	??	??	

?? =

AF: ASBESTOS FABRIC	F9: 9X9 FLOOR TILE	SC: STIPPLE CEILING
BR: BOILER REFRACTORY	F12: 12X12 FLOOR TILE	SO: SPRAY ON
CA: CAULKING	HB: HARDBOARD	ST: STUCCO
C12: 12X12 CEILING TILE	MA: MASTIC	TI: TANK INSULATION
C24: 24X24 CEILING TILE	PF: PIPE FITTING INSULATION	TP: TRANSITE PIPE
C48: 24X48 CEILING TILE	PI: PIPE INSULATION	VE: VERMICULITE
DC: DRYWALL COMPOUND	PL: PLASTER	
DI: DUCT INSULATION	RD: ROOF DRAIN	
FS: SHEET FLOORING		

NOTES:
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3. DO NOT DISTURB ASBESTOS. FOR HANDLING PROCEDURES CALL CENTRAL CONTROL AT 986-2382

ASBESTOS LOCATIONS

BUILDING: Archives Building
HB - 19
380 William Avenue
Winnipeg, Manitoba

REVISED BY:	DATE:	SCALE:	SHEET #:
REM	DECEMBER 15, 2021	N.T.S.	2/3

CITY OF WINNIPEG
PLANNING, PROPERTY & DEVELOPMENT DEPARTMENT
MUNICIPAL ACCOMMODATIONS DIVISION
4th FLOOR - 185 KING STREET
WINNIPEG, MANITOBA R3B 1J1
PHONE: (204) 986-7266
FAX: (204) 986-7311

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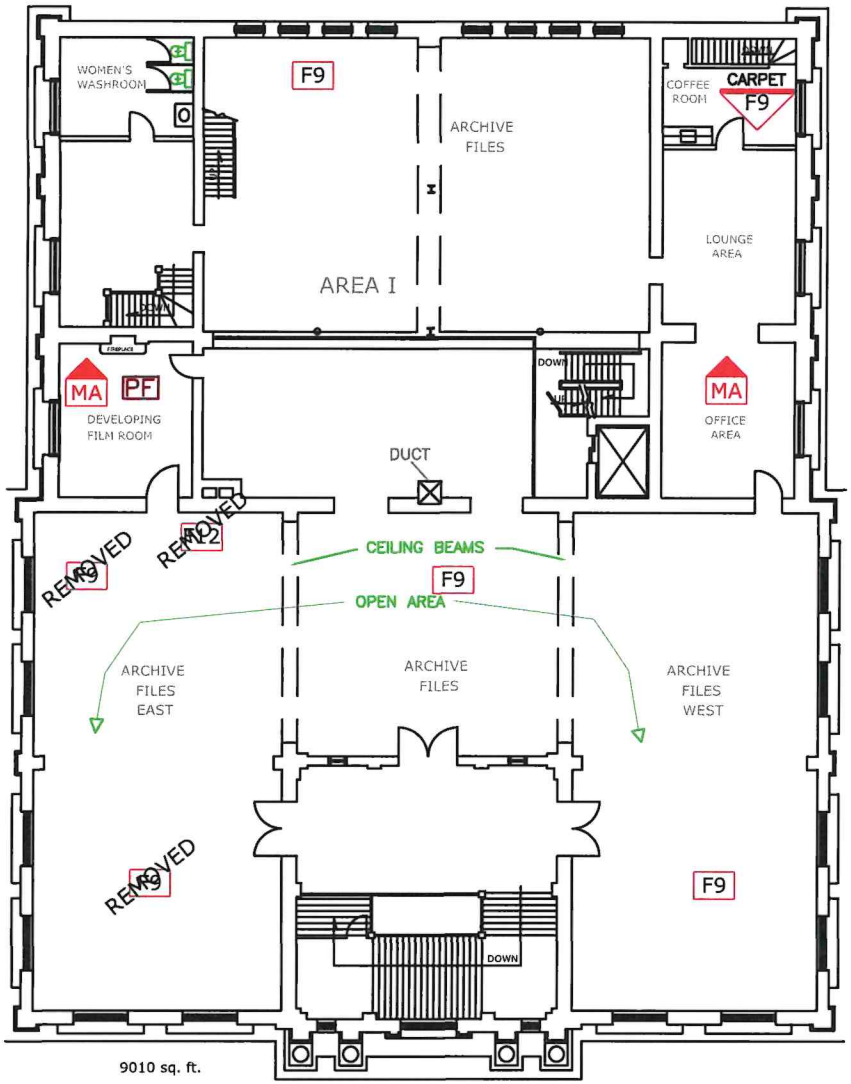
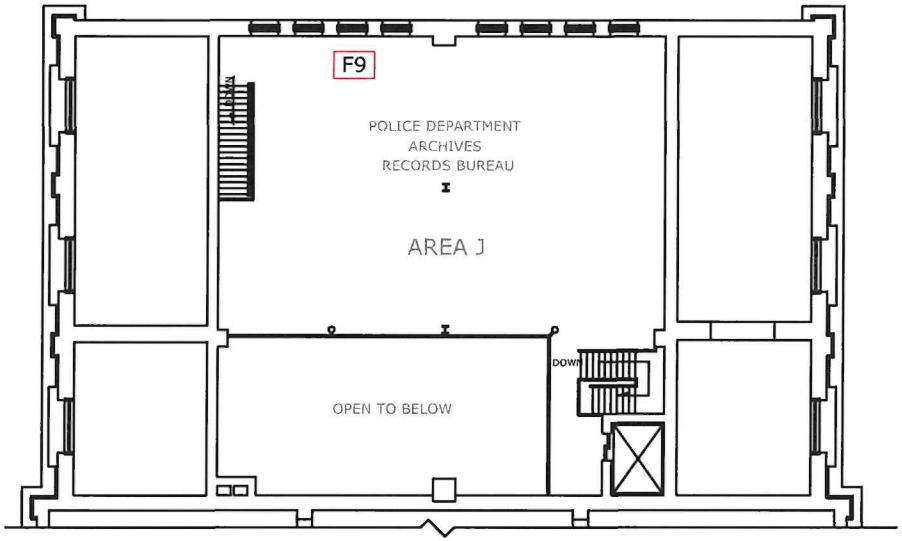


SECOND FLOOR PLAN



2ND FLOOR MEZZANINE PLAN

N

LEGEND

GENERAL LABELS	ON CEILING	ABOVE CEILING	UNDER FLOORING	WALL DETAIL	ENCAPSULATED ASBESTOS
??	??	??	??	??	

?? =

AF: ASBESTOS FABRIC	F9: 9X9 FLOOR TILE	SC: STIPPLE CEILING
BR: BOILER REFRACTORY	F12: 12X12 FLOOR TILE	SO: SPRAY ON
CA: CAULKING	HB: HARDBOARD	ST: STUCCO
C12: 12X12 CEILING TILE	MA: MASTIC	TI: TANK INSULATION
C24: 24X24 CEILING TILE	PF: PIPE FITTING INSULATION	TP: TRANSITE PIPE
C48: 24X48 CEILING TILE	PI: PIPE INSULATION	VE: VERMICULITE
DC: DRYWALL COMPOUND	PL: PLASTER	
DI: DUCT INSULATION	RD: ROOF DRAIN	
FS: SHEET FLOORING		

NOTES:
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ASBESTOS LOCATIONS

BUILDING: Archives Building
HB - 19
380 William Aveneu
Winnipeg, Manitoba

REVISED BY:	DATE:	SCALE:	SHEET #:
REM	OCTOBER 27, 2020	N.T.S.	3/3

CITY OF WINNIPEG
PLANNING, PROPERTY & DEVELOPMENT DEPARTMENT
MUNICIPAL ACCOMMODATIONS DIVISION
4th FLOOR - 185 KING STREET
WINNIPEG, MANITOBA R3B 1J1
PHONE: (204) 986-7266
FAX: (204) 986-7311

Winnipeg
Endless the Spirit • Vivez l'esprit

Site Location: 380 WILLIAM, WINNIPEG, MB
Your C.O.C. #: 1/1

Attention: Rodney Legault

PINCHIN LTD.
54 Terracon Pl.
Winnipeg, MB
CANADA R2J 4G7

Report Date: 2024/06/24
Report #: R3517923
Version: 2 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C443527
Received: 2024/06/12, 12:10

Sample Matrix: Soil
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Boron (Hot Water Soluble) (1)	1	2024/06/17	2024/06/17	AB SOP-00034 / AB SOP-00042	EPA 6010d R5 m
Hexavalent Chromium (1, 3)	1	2024/06/13	2024/06/14	AB SOP-00063	SM 24 3500-Cr B m
XRD (2)	1	N/A	2024/06/24		See Attachment
Elements by ICPMS - Soils (1)	1	2024/06/14	2024/06/15	AB SOP-00001 / AB SOP-00043	EPA 6020b R2 m
Moisture (1)	1	N/A	2024/06/14	AB SOP-00002	CCME PHC-CWS m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, EPA, APHA or the Quebec Ministry of Environment.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) This test was performed by Bureau Veritas Calgary, 4000 - 19 St. , Calgary, AB, T2E 6P8
(2) This test was performed by GR Petrology Consultants Inc.,
(3) Some soil samples may react with the Cr(VI) spike reducing it to Cr(III). These samples are highly unlikely to contain native hexavalent chromium. Thus a failed spike recovery does not invalidate a negative result on the native sample.

Bureau Veritas Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

Site Location: 380 WILLIAM, WINNIPEG, MB
Your C.O.C. #: 1/1

Attention: Rodney Legault

PINCHIN LTD.
54 Terracon Pl.
Winnipeg, MB
CANADA R2J 4G7

Report Date: 2024/06/24
Report #: R3517923
Version: 2 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C443527
Received: 2024/06/12, 12:10

Encryption Key

Bureau Veritas
24 Jun 2024 15:15:11

Please direct all questions regarding this Certificate of Analysis to:
Melissa McIntosh, Customer Solutions Representative
Email: melissa.mcintosh@bureauveritas.com
Phone# (204) 772-7276

==========

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Scott Cantwell, General Manager responsible for Manitoba Environmental laboratory operations.

Bureau Veritas Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

RESULTS OF CHEMICAL ANALYSES OF SOIL

Bureau Veritas ID		CPG403			CPG404	
Sampling Date		2024/06/03 12:00			2024/06/03 12:00	
COC Number		1/1			1/1	
	UNITS	S001- FLOOR FILL INSULATION - 2ND FLOOR	RDL	QC Batch	S002- FLOOR FILL INSULATION - 2ND FLOOR	QC Batch
Parameter						
Subcontract Parameter	N/A				ATTACHED	B414831
Elements						
Soluble (Hot water) Boron (B)	mg/kg	11	0.40	B404804		
Hex. Chromium (Cr 6+)	mg/kg	<0.080	0.080	B401740		
RDL = Reportable Detection Limit						

Bureau Veritas Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

PHYSICAL TESTING (SOIL)

Bureau Veritas ID		CPG403		
Sampling Date		2024/06/03 12:00		
COC Number		1/1		
	UNITS	S001- FLOOR FILL INSULATION - 2ND FLOOR	RDL	QC Batch
Physical Properties				
Moisture	%	1.4	0.30	B401588
RDL = Reportable Detection Limit				

Bureau Veritas Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

ELEMENTS BY ATOMIC SPECTROSCOPY (SOIL)

Bureau Veritas ID		CPG403		
Sampling Date		2024/06/03 12:00		
COC Number		1/1		
	UNITS	S001- FLOOR FILL INSULATION - 2ND FLOOR	RDL	QC Batch
Elements				
Total Antimony (Sb)	mg/kg	0.59	0.50	B403077
Total Arsenic (As)	mg/kg	5.8	1.0	B403077
Total Barium (Ba)	mg/kg	770	1.0	B403077
Total Beryllium (Be)	mg/kg	<0.40	0.40	B403077
Total Cadmium (Cd)	mg/kg	0.25	0.050	B403077
Total Chromium (Cr)	mg/kg	30	1.0	B403077
Total Cobalt (Co)	mg/kg	5.2	0.50	B403077
Total Copper (Cu)	mg/kg	82	1.0	B403077
Total Lead (Pb)	mg/kg	260	0.50	B403077
Total Mercury (Hg)	mg/kg	0.37	0.050	B403077
Total Molybdenum (Mo)	mg/kg	<0.40	0.40	B403077
Total Nickel (Ni)	mg/kg	10	1.0	B403077
Total Selenium (Se)	mg/kg	<0.50	0.50	B403077
Total Silver (Ag)	mg/kg	<0.20	0.20	B403077
Total Thallium (Tl)	mg/kg	0.18	0.10	B403077
Total Tin (Sn)	mg/kg	1.7	1.0	B403077
Total Uranium (U)	mg/kg	0.49	0.20	B403077
Total Vanadium (V)	mg/kg	11	1.0	B403077
Total Zinc (Zn)	mg/kg	500	10	B403077
RDL = Reportable Detection Limit				

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GENERAL COMMENTS

RESULTS OF CHEMICAL ANALYSES OF SOIL Comments

Sample CPG403 [S001- FLOOR FILL INSULATION - 2ND FLOOR] Boron (Hot Water Soluble): Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

Results relate only to the items tested.

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Bureau Veritas Job #: C443527
Report Date: 2024/06/24

QUALITY ASSURANCE REPORT

PINCHIN LTD.
Site Location: 380 WILLIAM, WINNIPEG, MB

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
B401588	Moisture	2024/06/14					<0.30	%	9.0	20		
B401740	Hex. Chromium (Cr 6+)	2024/06/14	89	75 - 125	88	80 - 120	<0.080	mg/kg	NC	35		
B403077	Total Antimony (Sb)	2024/06/15	79	75 - 125	104	80 - 120	<0.50	mg/kg	7.4	30		
B403077	Total Arsenic (As)	2024/06/15	93	75 - 125	105	80 - 120	<1.0	mg/kg	3.9	30	101	68 - 133
B403077	Total Barium (Ba)	2024/06/15	NC	75 - 125	107	80 - 120	<1.0	mg/kg	0.98	35	89	77 - 123
B403077	Total Beryllium (Be)	2024/06/15	98	75 - 125	106	80 - 120	<0.40	mg/kg	2.4	30	102	46 - 154
B403077	Total Cadmium (Cd)	2024/06/15	100	75 - 125	107	80 - 120	<0.050	mg/kg	3.5	30	100	56 - 147
B403077	Total Chromium (Cr)	2024/06/15	132 (1)	75 - 125	106	80 - 120	<1.0	mg/kg	2.8	30	88	65 - 136
B403077	Total Cobalt (Co)	2024/06/15	95	75 - 125	107	80 - 120	<0.50	mg/kg	4.7	30	94	79 - 122
B403077	Total Copper (Cu)	2024/06/15	91	75 - 125	107	80 - 120	<1.0	mg/kg	2.7	30	92	83 - 117
B403077	Total Lead (Pb)	2024/06/15	93	75 - 125	111	80 - 120	<0.50	mg/kg	2.0	35	93	87 - 113
B403077	Total Mercury (Hg)	2024/06/15	84	75 - 125	113	80 - 120	<0.050	mg/kg	NC	35	85	71 - 129
B403077	Total Molybdenum (Mo)	2024/06/15	106	75 - 125	110	80 - 120	<0.40	mg/kg	5.4	35	102	69 - 132
B403077	Total Nickel (Ni)	2024/06/15	NC	75 - 125	108	80 - 120	<1.0	mg/kg	2.8	30	97	85 - 115
B403077	Total Selenium (Se)	2024/06/15	91	75 - 125	102	80 - 120	<0.50	mg/kg	NC	30		
B403077	Total Silver (Ag)	2024/06/15	98	75 - 125	108	80 - 120	<0.20	mg/kg	NC	35	92	82 - 118
B403077	Total Thallium (Tl)	2024/06/15	97	75 - 125	112	80 - 120	<0.10	mg/kg	3.8	30		
B403077	Total Tin (Sn)	2024/06/15	100	75 - 125	107	80 - 120	<1.0	mg/kg	3.3	35		
B403077	Total Uranium (U)	2024/06/15	87	75 - 125	111	80 - 120	<0.20	mg/kg	4.2	30	92	78 - 121
B403077	Total Vanadium (V)	2024/06/15	NC	75 - 125	106	80 - 120	<1.0	mg/kg	9.3	30	99	69 - 131
B403077	Total Zinc (Zn)	2024/06/15	NC	75 - 125	102	80 - 120	<10	mg/kg	2.9	30		
B404804	Soluble (Hot water) Boron (B)	2024/06/17	111	75 - 125	105	80 - 120	<0.10	mg/kg	2.9	35		

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

Bureau Veritas Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Neenu Jose, Project Solutions Representative

Suwan (Sze Yeung) Fock, B.Sc., Scientific Specialist

Veronica Falk, B.Sc., P.Chem., QP, Scientific Specialist, Organics

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Scott Cantwell, General Manager responsible for Manitoba Environmental laboratory operations.

Bureau Veritas Winnipeg: Unit D, 675 Berry Street R3H 1A7 Telephone (204) 772-7276 Fax (204) 772-2386

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- ☐ Winnipeg, MB: D-675 Berry St. R3H 1A7 Toll Free (866) 800-6208

CHAIN OF CUSTODY RECORD

ENV COC - 00013v5

Invoice Information	Invoice to (requires report) ☑	Report Information (if differs from invoice)		Project Information	
Company:	Pinchin Ltd.	Company:		Quotation #:	LAB USE ONLY - PLACE STICKER HERE
Contact Name:	Rodney Legault	Contact Name:		P.O. #/ AFE#:	
Street Address:	54 Terracon Place	Street Address:		Project #:	
City: Winnipeg Prov: MB Postal Code: R2J4G7		City: Prov: Postal Code:		Site #:	
Phone:	204.452.0983	Phone:		Site Location:	380 William, Winnipeg, MB
Email:	rlegault@pinchin.com	Email:		Site Location Province:	Rush Confirmation #:
Copies:		Copies:		Sampled By:	

Regulatory Criteria

☐ AT1 ☐ CCME ☐ Drinking Water - Canada ☐ Drinking Water - Manitoba
☐ Saskatchewan ☐ Drinking Water - Alberta ☐ Other _____

SAMPLES MUST BE KEPT COOL (<10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS

Regular Turnaround Time (TAT)
☑ 5 to 7 Day ☐ 10 Day

Rush Turnaround Time (TAT) Surcharges apply
☐ Same Day ☐ 1 Day ☐ 2 Day ☐ 3 Day ☐ 4 Day
Date Required: YY MM DD
Comments

	Sample Identification	Date Sampled YY	MM	DD	Time (24hr) HH	MM	Matrix	1 FIELD FILTERED	2 FIELD PRESERVED	3 LAB FILTRATION REQUIRED	4 BTEX F1	5 VOCs	6 BTEX F1-F2	7 BTEX F1-F4	8 Routine water	9 Regulated metals - total	10 Regulated metals - dissolved	11 Mercury - total	12 Mercury - dissolved	13 Salinity 4	14 Sieve (75 micron)	15 Texture (% sand, silt, clay)	16 Basic class II landfill	17 CCME REGULATED METALS	18 FULL SCALE XRD	19	20	21 # OF CONTAINERS SUBMITTED	22 HOLD - DO NOT ANALYZE
1	S001 - Floor Fill Insulation - 2nd Floor	24	06	03	12	00																		X					
2	S002 - Floor Fill Insulation - 2nd Floor	24	06	03	12	00																			X				
3																													
4																													
5																													
6																													
7																													
8																													
9																													
10																													
11																													
12																													

MCAL-2024-06-1100

*UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BUREAU VERITAS STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS AND CONDITIONS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVNA.COM/TERMS-AND-CONDITIONS OR BY CALLING THE LABORATORY LISTED ABOVE TO OBTAIN A COPY

LAB USE ONLY	Yes	No	°C	1	2	3
Seal present		✓				
Seal intact						
Cooling media present		✓				
				23.1	23.6	23.2

LAB USE ONLY	Yes	No	°C	1	2	3
Seal present	—					
Seal intact	—					
Cooling media present	—					
				MCAL 1.9	2.0	3.1

LAB USE ONLY	Yes	No	°C	1	2	3	Temperature reading by:
Seal present		X					
Seal intact							
Cooling media present							
				20.5	20.3	20.5	

Relinquished by: (Signature/ Print)	Date YY	MM	DD	Time HH	MM	Received by: (Signature/ Print)	Date YY	MM	DD	Time HH	MM	Special Instructions
1 Rodney Legault	24	06	11	12	05	1 [signature] / LAURA COUPLAND	24	06	12	12	10	
2						2 [signature] Shaira Luc	24	06	13	08	20	

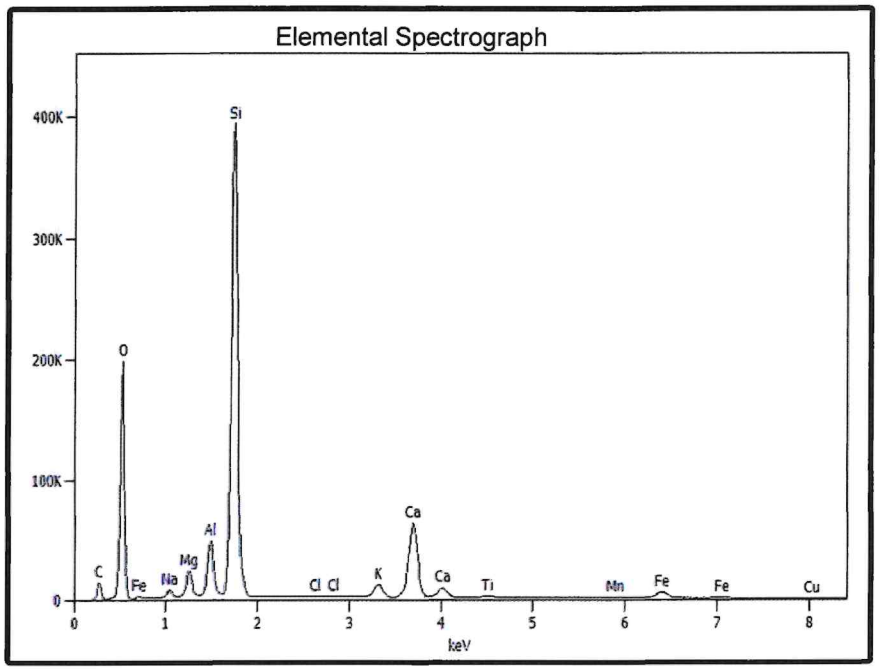
XRD, SEM, and Elemental Analysis
of
One Solid Sample
for
Bureau Veritas Laboratories
Project #: C443527
GR 37130 2024

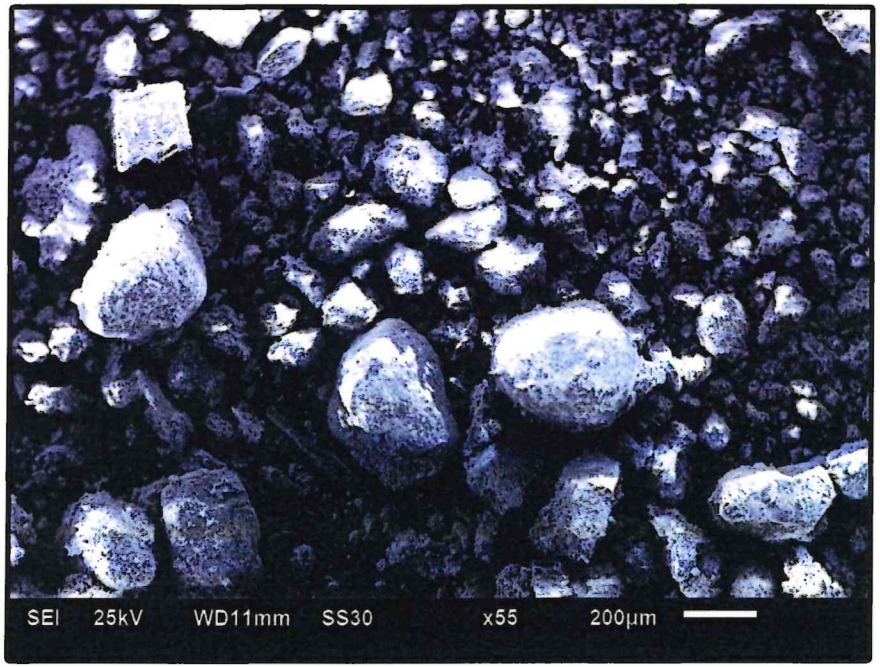
GR Petrology Consultants Inc.
Suite 8, 1323 – 44th Avenue N.E.
Calgary, Alberta T2E 6L5
Tel: 403-291-3420
E-mail: berna.hablado@grpetrology.com

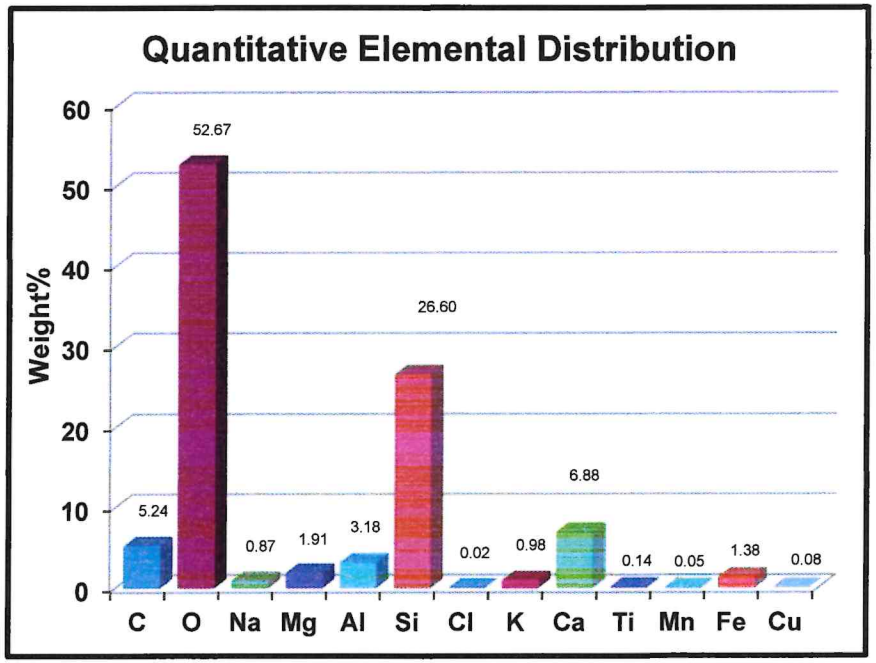
June 2024

GR Petrology CONSULTANTS Inc.

Bureau Veritas Laboratories; Project #: C443527
Sample ID: CPG404-S002-FLOOR FILL INSULATION - 2ND FLOOR
Date Sampled: 2024/06/03 12:00







Summary of Analyses

One solid sample (Sample ID: CPG404-S002-FLOOR FILL INSULATION - 2ND FLOOR; Date Sampled: 2024/06/03 12:00) was submitted by Bureau Veritas Laboratories for bulk X-ray Diffraction Analysis (XRD), elemental analysis by X-ray Energy Dispersive Spectrometry (EDS) and Scanning Electron Microscopy (SEM).

Quantitative elemental analysis was performed by a **Thermo Fisher Scientific *Pathfinder* X-ray Microanalysis System** attached to a **JEOL JSM-6610** scanning electron microscope. The Pathfinder system was designed to obtain standardless quantitative elemental analysis from rough samples by SEM. Elements from carbon (C) and heavier on the periodic table can be quantified.

The following Tables, Figures and Plates are included in this report:

- Table A: Comparison of Elemental Composition by EDS and XRD
- Plate 1: Photographs and EDS Results
- Table 1: EDS and XRD Results
- Figure 1: Bulk X-Ray Diffractogram

The scanning electron photomicrograph on the facing page (lower left) shows the sample consists of loose grains and aggregates of angular, subangular, subrounded, rounded and elongated, clay size to fine sand size particles. The upper left photograph illustrates the bulk sample.

Oxygen (O) and silicon (Si) dominate the elemental spectrograph, respectively forming about 52.7% and 26.6% of the sample. Carbon (C), aluminum (Al) and calcium (Ca) are moderately abundant, respectively forming about 5.2%, 3.2% and 6.9% of the sample. Trace to minor amounts of sodium (Na), magnesium (Mg), chlorine (Cl), potassium (K), titanium (Ti), manganese (Mn), iron (Fe) and copper (Cu) are present.

The sample generated a good quality diffractogram indicating the sample is mainly composed of crystalline compounds.

X-ray diffraction analysis shows the crystalline components of the sample consist of about 86% silicates (**quartz [SiO_2]**, **microcline [$KAlSi_3O_8$]**, **albite [$NaAlSi_3O_8$]**, **kaolinite [$Al_2Si_2O_5(OH)_4$]**, **clinochlore [$(Mg,Fe,Al)_6(Si,Al)_4O_{10}(OH)_2$]** and **illite [$(K,H_3O)Al_2Si_3AlO_{10}(OH)_2$]**), 7% calcium carbonate (**calcite [$CaCO_3$]**), 6% calcium magnesium carbonate (**dolomite [$CaMg(CO_3)_2$]**) and 1% sodium calcium magnesium manganese silicate hydroxide (**richterite, mn+2 [$(Na,Ca)_2(Mg,Mn,Fe)_5Si_8O_{22}(OH)_2$]**).

Elemental analysis also suggests the presence of non-crystalline carbon and calcium bearing compounds. Trace volumes of chlorine, titanium and copper bearing compounds were detected during elemental analysis.

Comparison of EDS and XRD Results

In many cases the EDS weight percent calculation for some of the elements is different from the XRD weight percent calculation. EDS analysis identifies and quantifies elements present in both crystalline and non-crystalline components. XRD analysis only detects elements in crystalline compounds because only crystalline components of the sample diffract X-rays. Thus, our XRD weight percent calculation can only include those elements present in the crystalline compounds. It must be emphasized that each element identified by X-ray diffraction analysis should also be detected by EDS; however, the reverse is not necessarily true.

Note: Hydrogen (H) can not be detected in EDS analysis; therefore, can not be compared.

Table A summarizes the following comments regarding the comparison of EDS and XRD results.

The sample showed a moderate to good correlation between the XRD and EDS results.

A moderate difference with respect to silicon was found in the sample.

- Silicon was measured at 26.60% in the elemental analysis, while XRD analysis detected 38.26% silicon.

Minor differences with respect to carbon and calcium were noted in the sample.

- In the elemental analysis, carbon forms 5.24% of the sample, while 1.63% carbon was detected in XRD analysis.
- EDS analysis detected 6.88% calcium, while XRD analysis detected 4.24% calcium.

The EDS results for carbon and calcium are greater than the XRD results indicating the presence of non-crystalline carbon and calcium bearing compounds. The XRD result for silicon is greater than the EDS result indicating this element occurs in well-crystalline compounds.

GR Petrology usually mounts a ground sample on a glass slide for X-ray diffraction analysis. The X-ray beam scans an area of approximately 250mm^2; however, the electron beam in the EDS that generates the elemental analysis scans a much smaller area of approximately 6mm^2. We attempted to obtain the elemental analysis from the most representative area of the sample; however, the irregular distribution of the materials in the sample may have skewed the EDS results in some instances.

Apparent differences in the elemental weight percent calculation of the above-mentioned elements are a function of:

1) The presence of non-crystalline components in the sample.
2) The difference in the area analysed by both methods.

COMPANY: Bureau Veritas Laboratories
PROJECT #: C443527
GR PROJECT #: GR 37130 2024

TABLE A
Comparison of Elemental Composition by EDS and XRD

GR Sample #	Sample ID	H	C	N	O	Na	Mg	Al	Si	P	Cl	K	Ca	Ti	Mn	Fe	Cu
GR-001	CPG404-S002-FLOOR FILL INSULATION - 2ND FLOOR	-	5.24	-	52.67	0.87	1.91	3.18	26.60	-	0.02	0.98	6.88	0.14	0.05	1.38	0.08
		0.01	1.63	-	51.79	0.50	0.84	1.41	38.26	-	-	0.99	4.24	-	0.12	0.21	-

H - Hydrogen	Mg - Magnesium	K - Potassium	Cu - Copper
C - Carbon	Al - Aluminum	Ca - Calcium	
N - Nitrogen	Si - Silicon	Ti - Titanium	
O - Oxygen	P - Phosphorus	Mn - Manganese	Black - EDS Analysis
Na - Sodium	Cl - Chlorine	Fe - Iron	Red - Calculated from XRD

GR Petrology CONSULTANTS Inc.

TABLE 1: EDS and XRD Results

Bureau Veritas Laboratories; Project #: C443527; Sample ID: CPG404-S002-FLOOR FILL INSULATION - 2ND FLOOR; Date Sampled: 2024/06/03 12:00

GR 37130-01 2024

ELEMENTS:

DOMINANT: O, Si

COMMON:

MODERATE: C, Al, Ca

MINOR-TRACE: Na, Mg, Cl, K, Ti, Mn, Fe, Cu

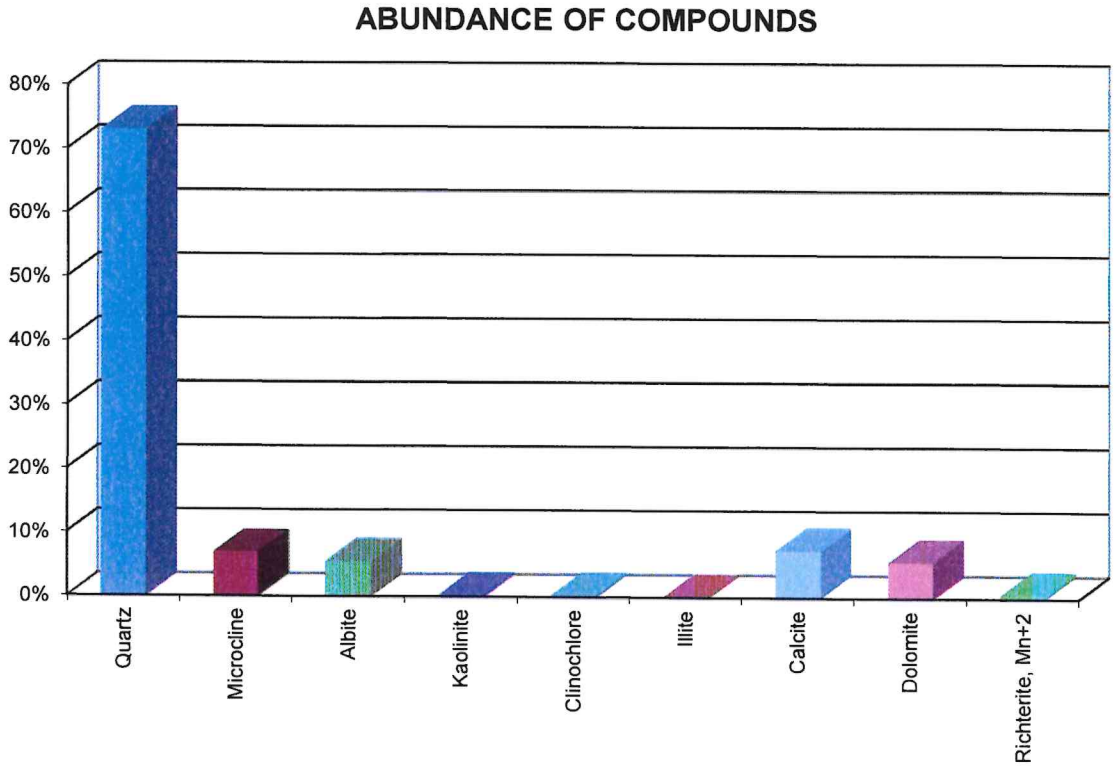
COMPOUNDS:

Formula	*Name*	*Percentage*
SiO_2	Quartz	73.1%
$KAlSi_3O_8$	Microcline	6.9%
$NaAlSi_3O_8$	Albite	5.5%
$Al_2Si_2O_5(OH)_4$	Kaolinite	0.3%
$(Mg,Fe,Al)_6(Si,Al)_4O_{10}(OH)_2$	Clinochlore	0.3%
$(K,H_3O)Al_2Si_3AlO_{10}(OH)_2$	Illite	0.2%
$CaCO_3$	Calcite	7.4%
$CaMg(CO_3)_2$	Dolomite	5.7%
$(Na,Ca)_2(Mg,Mn,Fe)_5Si_8O_{22}(OH)_2$	Richterite, Mn+2	0.6%
		100.0%

COMMENTS:

The sample generated a good quality diffractogram indicating the sample is mainly composed of crystalline compounds. X-ray diffraction analysis shows the crystalline components of the sample consist of about 86% silicates, 7% calcium carbonate, 6% calcium magnesium carbonate and 1% sodium calcium magnesium manganese silicate hydroxide.

Elemental analysis also suggests the presence of non-crystalline carbon and calcium bearing compounds. Trace volumes of chlorine, titanium and copper bearing compounds were detected during elemental analysis.



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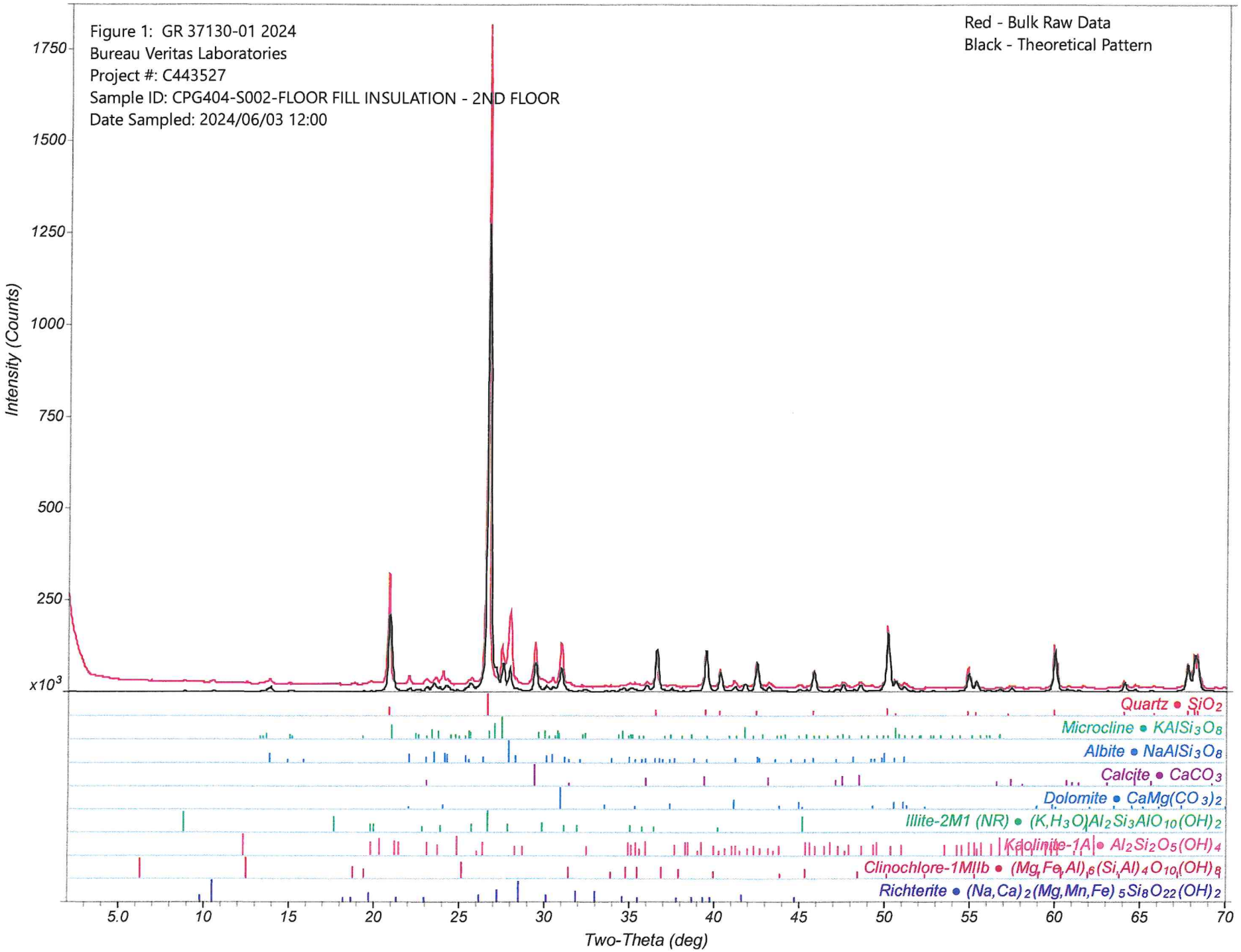


Figure 1: GR 37130-01 2024
Bureau Veritas Laboratories
Project #: C443527
Sample ID: CPG404-S002-FLOOR FILL INSULATION - 2ND FLOOR
Date Sampled: 2024/06/03 12:00
Red - Bulk Raw Data
Black - Theoretical Pattern
Intensity (Counts)
x10³
1750
1500
1250
1000
750
500
250
Quartz • SiO2
Microcline • KAlSi3O8
Albite • NaAlSi3O8
Calcite • CaCO3
Dolomite • CaMg(CO3)2
Illite-2M1 (NR) • (K,H3O)Al2Si3AlO10(OH)2
Kaolinite-1A • Al2Si2O5(OH)4
Clinochlore-1MIIb • (Mg,Fe,Al)6(Si,Al)4O10(OH)8
Richterite • (Na,Ca)2(Mg,Mn,Fe)5Si8O22(OH)2
5.0
10
15
20
25
30
35
40
45
50
55
60
65
70
Two-Theta (deg)

APPENDIX C

WINDOW ASSESSMENT REPORT

MCM - 380 William - City of Winnipeg Archives
Site Construction: General Notes & Restoration Scope

General Elevation Conditions:
The windows on the main floor are generally in better condition than those on the second floor.
There are signs of a red base layer of paint in several areas.

North Elevation:
The windows on the north elevation have greater potential for restoration than those on other sides of the building.
The main floor windows are in average condition and could be restored, though the bottom rails of the large sashes and the windowsills will need to be replaced.
The second-floor windows have suffered significant deterioration due to moisture exposure.

South Elevation:
The main floor windows are in better condition, as they are protected by the adjacent building and by hoarding that has been in place for an undetermined period.
The first-floor windows remain in good condition due to this protection.
Among the second-floor windows, the south-facing ones are in the worst condition.
The frames of the second-floor mezzanine windows have deteriorated beyond repair due to prolonged sun exposure. The other second-floor windows facing south are also heavily damaged by direct sunlight, resulting in severe, irreparable damage to their frames and sashes.
All windows are fitted with exterior storm panels, and some include a sliding vent for ventilation. They are all true divided lite panes.

East Elevation:
The main floor windows are in poor condition overall, though they are in better shape than the second-floor windows.
The second-floor windows are in poor condition due to sun exposure.

West Elevation:
The main floor windows are in poor condition overall, but they are in better shape than the second-floor windows.
The second-floor windows are in poor condition due to sun exposure.

Basement:
The basement windows are in good condition, as they have been protected by insulated hoarding.
The storm windows and screens are missing.

Front Entry Door:
The front entry door is in good condition, though there is some weathering on the lower portion of the door and frame.
It is recommended that the door and frame be stripped and refinished. Additionally, the hinges will need to be replaced.

Screens:
The green paint on the sashes behind the screens differs from the green on the rest of the exterior windows. This discrepancy may be due to the screens being nailed in place, which prevented them from being removed during maintenance painting. This also likely contributed to the more severe deterioration of the transom sashes behind the screens.
The wood screens are beyond repair. The metal mesh is rusted, and the wood is rotting with missing parts. Originally, the screens were secured with eyes and hooks, but they are now nailed in place.

Storm Windows:
The interior storm windows provide both decorative detail and insulation, and as such, should remain as part of the original window configuration.
Full Fixed Interior Storms (Two-Panel, True Divided Lite):
The following windows feature full fixed interior storms with true divided lite panes, consisting of a two-panel fixed storm system:

Windows 2-01, 2-02, 2-06, 2-07, 2-31, 2-32, 2-33, 1-08, 1-09, 1-10, 1-11

Full Fixed Interior Storms with Vent Panels:
These windows are full fixed interior storms with true divided lite panes, and include vent panels for access to the double-hung sash locks:

Windows 2-12, 2-13, 2-14, 2-31, 2-32, 2-33
(All of these units have double-hung sashes on the exterior.)

Additional Full Fixed Interior Storms (Two-Panel, True Divided Lite):
The following windows are also full fixed interior storms with true divided lite panes, featuring a two-panel fixed storm system:

Windows 1-01, 1-02, 1-05, 1-06, 1-07, 1-42, 1-43, 1-44, 1-45

Full Fixed Interior Storms with Vent Panels (Access to Sash Locks):
These windows have full fixed interior storms with true divided lite panes, and vent panels for accessing the double-hung sash locks:

Windows 1-11, 1-12, 1-13, 1-14, 1-15, 1-16, 1-36, 1-37, 1-40, 1-41
(These units also feature double-hung sashes on the exterior.)

MCM - 380 William - City of Winnipeg Archives
Site Construction: General Notes

1-03: The inside check rail window is painted red on the outside, which was possibly the original colour.

1-28: The south wall windows on the main floor have been protected from the adjacent building and have had very little sunlight as a result of the windows are in much better condition than the second floor windows.

2-03: Red paint visible on exterior

2-14: Red paint visible on exterior

2-12, 2-13, 2-14, 2-31, 2-32, 2-33: Vertical bracing has been added to prevent the meeting rail from collapsing.

2-23 and 2-24: Storms windows: Every other storm on the south wall has a sliding vent.

2-37: Both exterior and interior of sashes were original painted green.

General slilding storm window vent

MCM - 380 William - City of Winnipeg Archives
Site Construction: Sill Conditions


General sill condition with alumiinum cladding repair


General sill condition with pressure treated repair


General sill detail with no repair


General sill condition

MCM - 380 William - City of Winnipeg Archives
Site Construction: Screen Conditions

Window screens
The wood screens are deteriorated beyond repair on the east and west elevations. North elevation screens are in better condition and can be restored. The metal meshing is rusted and the wood is rotting and has missing parts. They were originally held on with eyes and hooks but are now now nailed in place.


Typical second floor transom screen


Typical second floor transom screen detail

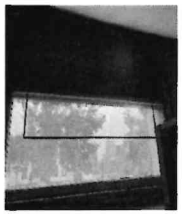

Typical second floor transom screen detail


General transom screen on main floor windows


General transom

MCM - 380 William - City of Winnipeg Archives
Site Construction: Basement Windows

The original storm windows and screens are missing.



All basement windows were covered with Styrofoam and two sheets of plywood, along with a wood moulding on the outside. The interior sashes were mostly intact.

The window sill and brickmould are in good condition.

MCM - 380 William - City of Winnipeg Archives
Site Construction: Typical Window Construction

Typical Elevation:1-01, 1-02, 1-05, 1-06, 1-07, 1-08, 1-09, 1-10, 1-45, 1-44, 1-43, 1-42
*Restoration notes in BLUE

Typical Elevation

Transom

Sill

Interior view of bottom rail

Interior view of TDL

Interior View

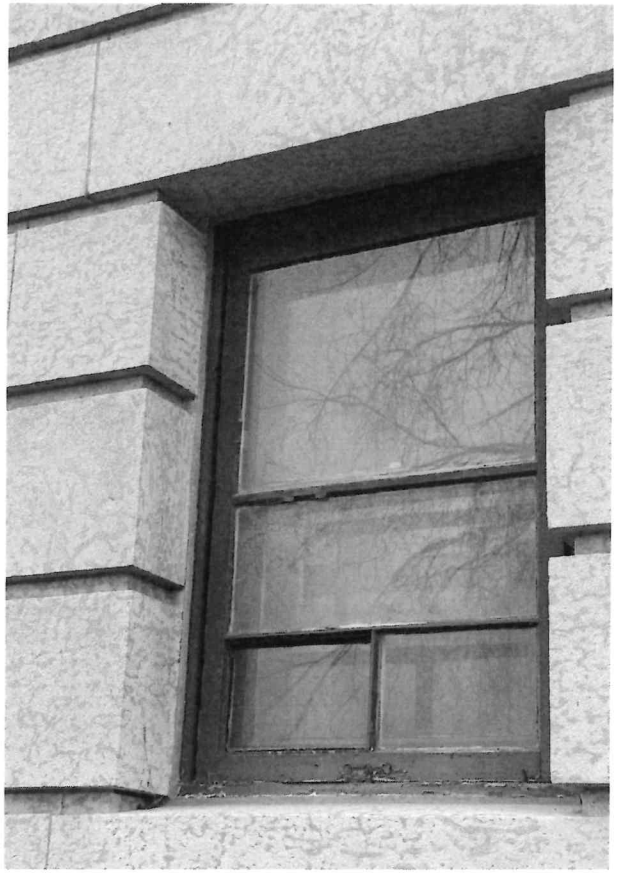
Interior window stop

Interior view of sash lock and screen

MCM - 380 William - City of Winnipeg Archives
Site Construction: Typical Window Construction

Typical Elevation:1-03, 1-04

Typical Elevation



Typical Elevation

MCM - 380 William - City of Winnipeg Archives
Site Construction: Typical Window Construction

Typical Elevation:1-11, 1-12, 1-13, 1-14, 1-15, 1-16, 1-36, 1-37, 1-40, 1-41

Typical Elevation

Hopper sash with chain stay

Exterior view: mullpost

Interior view: check rail, storm window and sliding window

Interior view of meeting rail

Interior mullion detail

Interior of transom

Sill detail

MCM - 380 William - City of Winnipeg Archives
Site Construction: Typical Window Construction

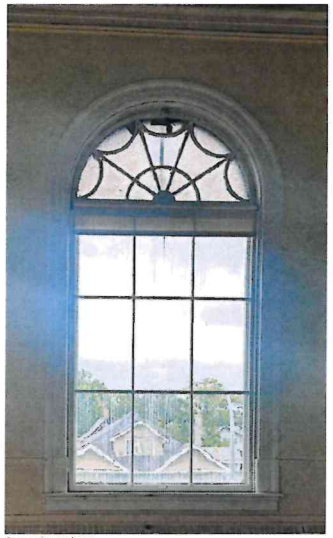
Typical Elevation:1-38, 1-39

Typical Elevation

MCM - 380 William - City of Winnipeg Archives
Site Construction: Typical Window Construction

Typical Elevation: 2-01, 2-02, 2-06, 2-07, 2-08, 2-09, 2-10, 2-11, 2-34, 2-35, 2-36, 2-37

Typical Elevation



Interior view

Typical sill detail. All bottom sashes and sills are rotted.

Transom detail. All transom sashes are deteriorated beyond repair.

Interior storm windows are in good shape. Some require interior paint. All require a limited amount of putty work on the exterior.

Jamb detail with window stop and interior storm are in good condition.

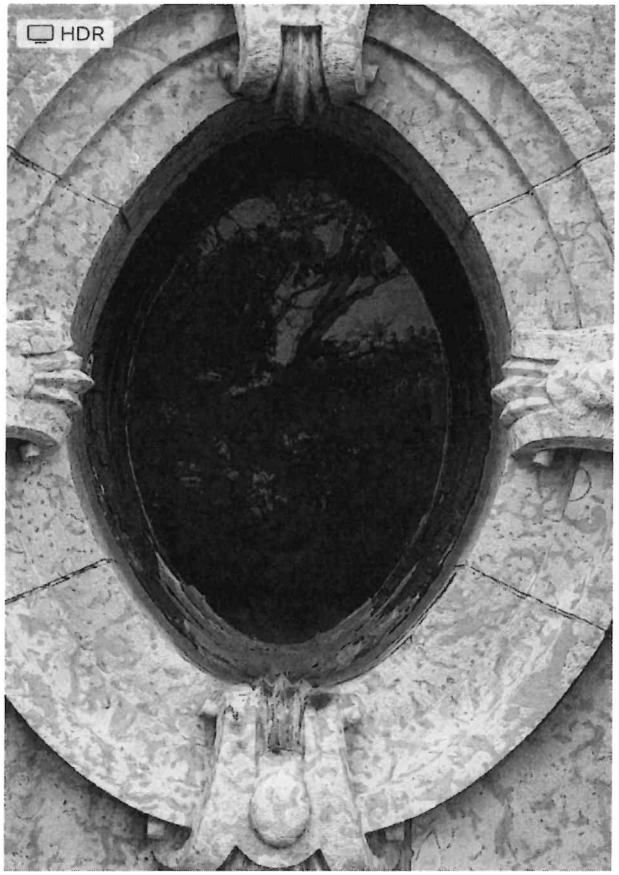
View of lower interior and exterior sashes.

Transom clasps are either broken or seized.

Interior view of transom sash. Hinges are rusted and need to be replaced.

MCM - 380 William - City of Winnipeg Archives
Site Construction: Typical Window Construction

Typical Elevation: 2-03, 2-05



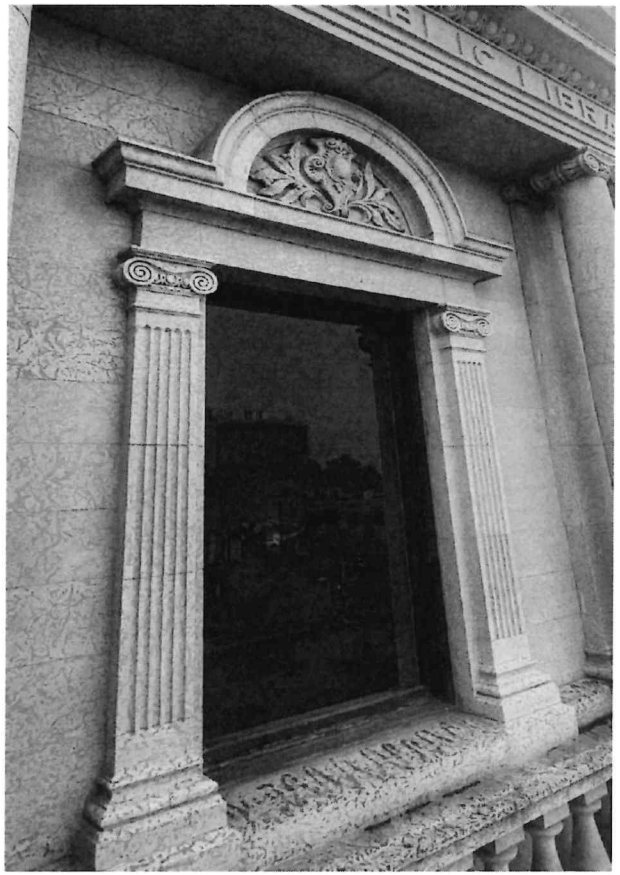
Typical Elevation

Interior view.

Exterior view. The brick mould and lower portion of the sash are deteriorated. They will need to be replaced.

MCM - 380 William - City of Winnipeg Archives
Site Construction: Typical Window Construction

Typical Elevation: 2-04



Typical Elevation

MCM - 380 William - City of Winnipeg Archives
Site Construction: Typical Window Construction

Typical Elevation: 2-12, 2-13, 2-14, 2-31, 2-32, 2-33

Typical Elevation

Typical sill detail with flashing to cover deteriorated sills.

Transom sash all exhibit a combination of broken glass, rotted muntin bars, loose putting and metal bracing to hold them together.

Typical transom detail. Note eye-and-hook indicate the original screens were held on by these fasteners. Current screens are nails on with 3" nails

All meeting rails have failed and are held together with metal brackets.

Center support brace to hold up failed meeting rail

Center support brace detail

Interior trim appears to be oak.

Interior storm window profile and putty deterioration

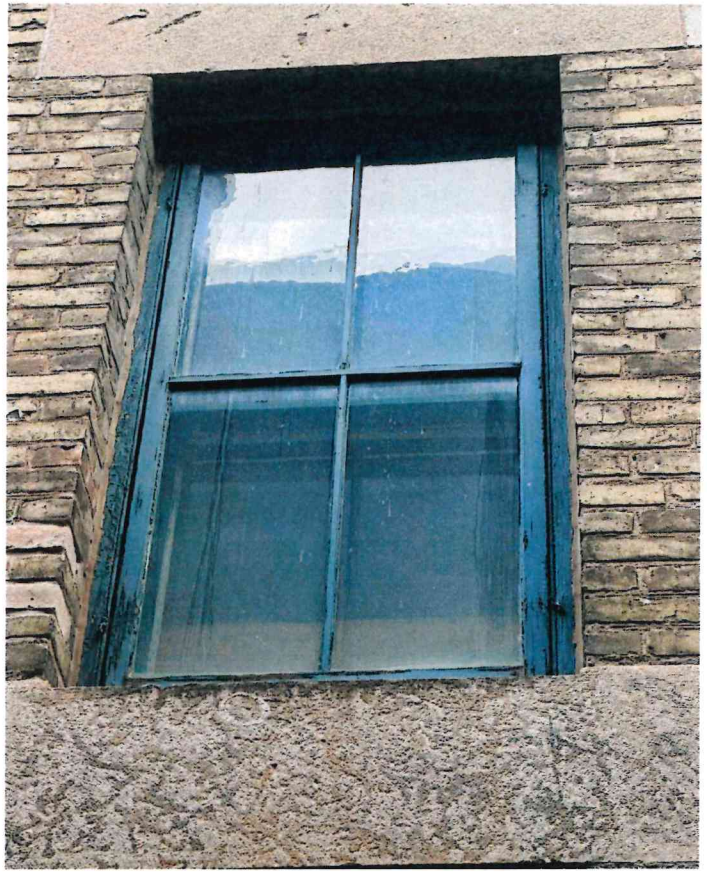
Venting window in open position

Interior storm window with hinge venting window

Interior View of meeting rail through vent window

MCM - 380 William - City of Winnipeg Archives
Site Construction: Typical Window Conditions

Typical Elevation: South Elevation



Typical Elevation

Typical venting storm sash.

Double hung window damage occupants prying double hung sash down.

All sliding windows are weight and pully double hung with a sash rope cord

Weight pully with sash rope cord missing on the majority of the windows.

Typical interior view.

Window 2-23 - 2-30. windows are highly exposed to the sunlight and are are severely deteriorated

Windows 1-28 through 1-35 and 2-15 through 2-22 are in better condition because they are protected by the adjacent building

Inside view of venting storm window.

Upper sash meeting rail failure

MCM - 380 William - City of Winnipeg Archives
Site Construction: Typical Window Construction

Typical Elevation: Front Door

Typical Elevation

Bottom of entry door requires stripping of finish and refinishing.

Hinges are rusted and need to be replaced with new NRP hinges

Higher areas of the door and sidelites are in good shape

Sidelite require stripping of finishing and refinishing.

MCM - 380 William - City of Winnipeg Archives
Restoration Recommendations

Window Types and Restoration Recommendations:
For restoration, it is recommended to replace all exterior storm windows, including those on the transom windows, with new dual-pane storm windows. The frames require new brick moldings and window sills. All the interior storm windows are in good condition and require some putty and paint.
All transom windows are beyond repair and should be replaced with new dual-pane replicas. They are all fixed in place and exhibit advanced deterioration. All of the hardware is either broken, frozen, missing or rusted. It appears the transom windows never had storm window as there is no evidence of fasteners.

1-01, 1-02, 1-05, 1-06, 1-07, 1-08, 1-09, 1-10, 1-45, 1-44, 1-43, 1-42

1. New dual pane transom
2. Restore mullion
3. New sash with dual pane (Accoya wood)
4. New trim (Accoya wood)
5. Repair sill (Accoya wood)

Note: Restore interior storm

1-03, 1-04

1. New sash with dual pane
2. New trim (Accoya wood)
3. Repair sill (Accoya wood)

Note: Restore exterior storm

1-11, 1-12, 1-13, 1-14, 1-15, 1-16, 1-36, 1-37, 1-40, 1-41

1. New dual pane transom
2. Restore mullion
3. New sash with dual pane (Accoya wood)
4. New trim (Accoya wood)
5. Repair sill (Accoya wood)

Note: Restore interior storm

1-38, 1-39

1. New double hung sash with dual pane (Accoya wood)
2. New trim (Accoya wood)
3. Repair sill (Accoya wood)

Note: Restore interior storm

2-01, 2-02, 2-06, 2-07, 2-08, 2-09, 2-10, 2-11, 2-34, 2-35, 2-36, 2-37

1. New dual pane transom
2. Restore mullion
3. New sash with dual pane (Accoya wood)
4. New trim (Accoya wood)
5. Repair sill(Accoya wood)

Note: Restore interior storm

MCM - 380 William - City of Winnipeg Archives
Restoration Recommendations

2-03, 2-05

1. Restore sash and exterior trim
2. Add dual pane glazing to existing sash

2-04

1. Restore sash and exterior trim
2. Repair sill
3. Add dual pane glazing to existing sash

2-12, 2-13, 2-14, 2-31, 2-32, 2-33

1. New dual pane transom
2. Restore mullion
3. New sash with dual pane (Accoya wood)
4. New trim (Accoya wood)
5. Repair sill(Accoya wood)

Note: Restore interior storm

South Elevation

1. New double hung sash with dual pane.
2. New trim
3. Repair sill
4. Restore / replace exterior storm as required.

Front Door

1. Strip and refinish door and frame.
2. Replace hinges with NRP
3. Interior requires touchups only

MCM - 380 William - City of Winnipeg Archives
Restoration Recommendations

Basement windows

1. Restore exterior trim and sills.
2. Restore interior double hung sash
3. Add dual pane storm windows

Table 1

WINDOW LOCATION	First Floor 1-01	1-02	1-03	1-04	1-05	1-06	1-07	1-08	1-09	1-10	1-11	1-12	1-15	1-17	1-18	1-19	1-20	1-21	1-22	1-23	1-24	1-25	1-26	1-26	1-28	1-29	1-30	1-31	1-32	1-33	1-34	1-35	1-36	1-37	1-38	1-39	1-40	1-41	1-42	1-43	1-44	1-45	Notes
GLASS CRACKED / MISSING																																											
Prime sash	N	N	N	N	N	N	Y	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	M	N	N	N	N	N	N	N	
Storm sash	N	N	N	X	N	N	N	N	Y	N	N	N	Y	N	N	N	Y	N	N	N	N	N	N	M	N	N	Y	N	N	N	N	N	N	Y	N	Y	N	Y	N	N	N	N	
Transom sash	N	N	X	X	N	N	Y	Y	Y	Y	Y	N	Y	X	X	X	X	X	X	X	X	X	N	X	X	X	X	X	X	X	X	X	N	N	X	X	Y	Y	N	N	N	N	
PUTTY CONDITION																																											
Prime sash	F	F	F	F	F	F	G	F	F	F	P	F	F	G	G	G	F	F	F	G	P	P	P	P	G	G	F	F	F	G	P	P	F	F	F	M	P	P	G	P	P	F	
Storm sash	X	X	P	X	X	X	X	X	X	P	P	P	P	F	F	P	P	P	P	F	P	P	P	M	F	P	P	P	P	F	P	P	P	P	P	P	P	F	X	X	X	X	
Transom sash	P	P	X	X	P	P	p	P	P	P	P	P	P	X	X	X	X	X	X	X	X	X	P	X	X	X	X	X	X	X	X	X	P	P	X	X	P	P	P	P	P	P	
SASH ALIGNMENT	G	G	F	F	G	G	G	G	G	P	P	P	P	F	F	G	F	F	G	G	P	F	P	P	F	G	F	F	G	G	P	F	G	G	G	G	F	P	F	G	G	G	
HARDWARE CONDITION	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	G	P	P	P	P	P	P	P	P	P	G	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
SASH ROT / DECAY																																											
Prime sash	G	G	F	F	F	F	G	G	G	F	F	G	G	G	G	G	G	F	F	G	F	F	G	P	G	G	G	F	F	G	F	F	F	F	F	F	P	F	G	G	G	G	
Storm	P	P	F	X	F	F	P	P	P	P	P	P	P	F	F	F	F	F	F	F	P	P	P	M	F	F	F	F	F	F	P	P	F	F	F	F	P	P	P	P	P	P	
Transom	P	P	X	X	F	F	Y	P	P	P	P	P	P	X	X	X	X	X	X	X	X	X	P	X	X	X	X	X	X	X	X	X	F	F	X	X	P	P	P	P	P	P	
DOES WINDOW OPEN	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	N	Y	N	N	N	Y	Y	Y	Y	Y	N	Y	N	N	N	Y	Y	Y	N	N	N	N	N	
COUNTERBALANCE OPERATE?	X	X	N	N	X	X	X	X	X	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	X	X	X	X	
IS THERE FRAME AND BRICKMOULD ROT	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
IS THE SILL CHECKING OR	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
IS THE SILL SLOPING?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Image No.																																											
OVERALL WINDOW CONDITION	P	P	F	F	F	F	P	P	P	P	P	P	P	F	F	F	F	F	F	F	F	F	P	P	F	F	F	F	F	F	F	F	F	F	F	F	P	P	P	P	P	P	
Window Grades	Good (G) Fair (F) Poor (P) Missing (M) Not applicable (X) Yes (Y) N0 (N)																																										
NOTES:																																											
	If counterbalance is checked with an X this type has none. If it has a N it means one or both cords are broken. Y means it's intact.																																										
	The wood screens that are in place are all in poor condition and non salvageable. If counterbalance is checked as no it means one or both cords are broken.																																										
	Prime sash as noted are the interior sashes in non transom locations. Sometimes they are fixed on the inside and sometimes they are check rail.																																										

WINDOW LOCATION	Second Floor																																					Notes
	2-01	2-02	2-03	2-04	2-05	2-06	2-07	2-08	2-09	2-10	2-11	2-12	2-13	2-14	2-15	2-16	2-17	2-18	2-19	2-20	2-21	2-22	2-23	###	###	###	###	###	###	###	2-31	2-32	2-33	2-34	2-35	2-36	2-37	
GLASS CRACKED / MISSING																																						
Prime sash	Y	Y	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	
Storm sash	N	N	X	X	X	N	N	N	N	N	N	N	Y	N	M	N	N	N	N	N	N	M	N	N	N	Y	N	N	N	Y	N	N	N	N	N	N	N	
Transom sash	Y	Y	X	X	X	Y	Y	Y	Y	Y	Y	N	Y	N	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Y	Y	N	Y	Y	Y	N	
PUTTY CONDITION																																						
Prime sash	P	P	X	X	X	G	G	F	F	F	P	F	F	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	F	P	F	F	F	G	G	
Storm sash	X	X	X	X	X	X	X	P	P	P	P	P	P	P	M	P	P	P	P	P	P	M	P	P	P	P	P	P	P	P	P	F	P	P	P	P	P	
Transom sash	p	P	X	X	X	p	p	P	P	P	P	P	P	P	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	P	P	P	P	P	P	P	
SASH ALIGNMENT	G	G	X	X	X	G	G	P	P	P	P	P	P	P	P	P	P	P	P	P	G	P	G	P	G	G	G	G	F	G	P	P	P	G	G	G	G	
HARDWARE CONDITION	P	P	X	X	X	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
SASH ROT / DECAY																																						
Prime sash	G	G	F	P	F	G	G	G	G	F	F	G	G	G	P	P	P	P	P	P	P	P	P	P	P	P	P	F	P	P	F	G	G	G	G	G	G	
Storm	P	P	X	X	X	P	P	P	P	P	P	P	P	P	M	P	P	P	P	P	P	M	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
Transom	P	P	X	X	X	Y	Y	P	P	P	P	P	P	P	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	P	P	P	P	P	P	P	
DOES WINDOW OPEN	N	N	X	X	X	N	N	N	N	N	N	N	N	N	N	Y	N	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	
COUNTERBALANCE OPERATE?	X	N	X	X	X	X	X	N	N	N	N	N	N	N	N	N	N	Y	N	Y	Y	Y	N	N	N	N	Y	N	N	N	N	N	N	X	X	X	X	
IS THERE FRAME AND BRICKMOULD ROT	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
IS THE SILL CHECKING OR ROT?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
IS THE SILL SLOPING?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Image No.																																						
OVERALL WINDOW CONDITION	P	F	G	P	G	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	F	F	F	F	

Window Grades	Good (G) Fair (F) Poor (P) Missing (M) Not applicable (X) Yes (Y) N0 (N)
NOTES:	
	If counterbalance is checked with an X there are none on this type. If N it means one or both cords are broken and if Y it is
	The remaining wood screens all are in poor condition.
	Prime sash as noted are the interior sashes in non transom locations. Sometimes they are fixed on the inside and sometimes they are check rail.

Table 1-1

	CITY ARCHIVES BASEMENT																															
WINDOW LOCATION	**Basement**																															**Notes**
	B-01	B-02	B-3	B-4	B-5	B-6	B-7	B-8	B-9	B-10	B-11	B-12	B-13	B-14	B-15	B-16	B-17	B-18	B-19	B-20	B-21	B-22	B-23	B-24	B-25	B-26	B-27	B-28	B-29	B-30	B-31	B-32	
GLASS CRACKED / MISSING																																
Check rail sash	N	N	N	N	N	Y	Y	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	M	N	N	N	N	
PUTTY CONDITION																																
Check rail sash	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	
SASH ALIGNMENT	G	G	F	F	G	G	G	G	G	P	P	P	P	P	P	P	F	G	F	F	G	G	P	F	G	G	G	G	F	P	F	G	
HARDWARE CONDITION	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
SASH ROT / DECAY																																
Check rail sash	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
DOES WINDOW OPEN	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	
COUNTERBALANCE OPERATE?	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	
IS THERE FRAME AND BRICKMOULD ROT	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
IS THE SILL CHECKING OR ROT?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
IS THE SILL SLOPING?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Image No.																																
OVERALL WINDOW CONDITION	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
Window Grades	Good (G) Fair (F) Poor (P) Missing (M) Not applicable (X) Yes (Y) N0 (N)																															
NOTES:																																
	There are no screens or storm windows remaining for the basement. They have been hoarded over and as such the check rail sashes are in fair condition																															

Guidelines for the Repair or Replacement of Windows in Historic Buildings

Windows Condition Assessment

Planning & Land Use, Heritage Unit, City of Winnipeg
Historic Resources Branch, Province of Manitoba
2010

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Image Front Cover:

The Province of Manitoba and the City of Winnipeg gratefully acknowledge the contribution of the Government of Canada Historic Places Intiative in supporting the creation of this document.

Canada's Historic Places / Lieux patrimoniaux du Canada

GETTING STARTED

One of the most common practices during renovation is to throw away old original windows. Removing historic windows decreases the heritage value of a historic building and should be a last resort. The Province of Manitoba and the City of Winnipeg have collaborated to prepare these guidelines to assist property owners, contractors and consultants when considering repair or replacement of original wood or metal windows in a historic building.

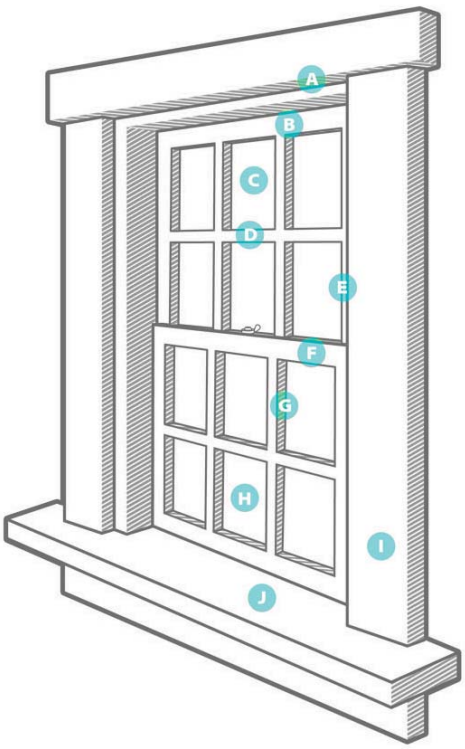
Life-cycle cost analysis has shown that replacing historic windows in order to reduce heating costs is largely a myth. The thermal and acoustic performance of old windows can be greatly improved through simple non-invasive strategies such as weather stripping and installing storm windows. Traditional windows are usually maintainable – nearly anything that goes wrong with them can be fixed. If you are facing operational problems with your old wood windows, it is possible to meet modern performance standards either by repairing and upgrading existing windows or, where this is not feasible, by providing new components that match the original design specifications.

GENERAL GUIDELINES

The City of Winnipeg and the Province of Manitoba support the objective, set forth by the *Standards and Guidelines for the Conservation of Historic Places in Canada,* that preservation and rehabilitation are always preferred over replacement. The first step in considering repair or replacement of windows in your historic building is to evaluate the architectural and historical significance of the windows. Original windows function as an integral part of the building's interior and exterior and contribute to the architectural rhythm of the facade. Removing historic windows negatively affects a building's appearance and the appearance of the entire streetscape. Where windows are original to the building and of special importance they will be included in the designated building's *Statement of Significance*, a brief report on what makes the site special. These can be found on the Canadian Register of Historic Places at www.historicplaces.ca.

ANATOMY OF A WINDOW

Understanding the parts and operation of your windows is the next step in assessing the window condition. Each component will need to be carefully examined visually and structurally when completing the Condition Assessment. The Condition Assessment should include notes and photographs. Deterioration should be photographed and images submitted to the appropriate heritage authority along with the Condition Assessment. Your photographs will support your observations. The value assigned to each window reflects whether the overall elements are in Good, Fair or Poor Condition and, in consultation with your local heritage authority, will determine any future changes.



A. Jamb
B. Rail
C. Pane or Light
D. Top Sash
E. Stile
F. Meeting Rail
G. Muntin Strip
H. Bottom Sash
I. Casing
J. Stool

Illustration by mckibillo. Used with permission. Courtesy of PRESERVATION magazine, National Trust for Historic Preservation.

EVALUATION STANDARDS

Use the evaluation standards to determine the condition for each historic window listed on the Condition Assessment.

Condition	Description
GOOD	A. The window is intact, structurally sound and performing its intended purpose. B. The window needs no repair and only minor or routine maintenance.
FAIR	A. There are early signs of wear, failure or deterioration, though the window is generally structurally sound and performing its intended purpose. B. There is a failure of a subcomponent of the window. C. Replacement of up to 30% of the window or replacement of a defective subcomponent is required.
POOR	A. The window is no longer performing its intended purpose and can not be made to do so. B. The window is missing C. Deterioration and damage affects more than 30% of the window and can not be adjusted or repaired. D. The window shows signs of imminent failure or breakdown

Owners of designated heritage buildings in the City of Winnipeg must still apply for a heritage permit from the Planning and Land Use, Heritage Unit. Provincially designated buildings still require a permit from the Historic Resources Branch. Municipally designated buildings outside the City of Winnipeg may require a permit from the local municipal government. Additional contact information is provided on page 15.

The Historical Windows Condition Assessment will help you to prioritize window repair work and determine which windows may be eligible for replacement. The Evaluation Standards (Good, Fair or Poor) are used to assess the condition of each window. Once the window condition has been determined, the Intervention Standards outline the appropriate treatment for each window.

INTERVENTION STANDARDS FOR HISTORIC WINDOWS

The following Intervention Standards are based on recommendations from the *Standards and Guidelines for the Conservation of Historic Places in Canada* and are strictly guidelines. Consult with your local heritage authority before taking action.

GOOD: PROTECT & MAINTAIN

The wood and architectural metals that comprise the window frames, sashes, muntins and surrounds should be protected and maintained through appropriate surface treatments such as cleaning, rust removal, limited paint removal and reapplication of protective coating systems in kind. Windows should be made weather tight by re-puttying, and replacing or installing weather-stripping.

FAIR: REPAIR & STABILIZE

Window units deemed as fair require repair and stabilization of deteriorated window elements using structural reinforcement, weather protection, or correcting unsafe conditions, as required, until any additional work is undertaken. Repairs should be physically and visually compatible. Where there are missing parts match to surviving prototypes. Refer to the Windows Guidelines for appropriate treatment of window components.

POOR: REPLACE IN KIND

Windows deemed as poor may be eligible for replacement in kind. The new work should match the old in form and detailing. Refer to the Windows Guidelines regarding replacement window elements. Contact the City of Winnipeg Planning & Land Use, Heritage Unit, the Historic Resources Branch of the Province of Manitoba, or your local municipal heritage authority to discuss an appropriate replacement window unit.

CONDITION ASSESSMENT FOR THE REPAIR AND REPLACEMENT OF HISTORIC WINDOWS

A window condition assessment is a careful evaluation of the existing physical condition of your historic windows on a unit-by-unit basis. In addition to the condition assessment, photo document is required. Either floor plans or exterior elevations can be submitted illustrating each window number that corresponds with the window location. Work through the list of questions for each window being assessed. When you are finished, assign an overall score to the window of Good, Fair or Poor. When you have completed the assessment submit the paperwork, plans and photographs to your local heritage authority for review.

WINDOW LOCATION: [1]	N1																			
	1																			
Is the window glass cracked or missing?	Y																			
If the glazing is puttied, has the putty gone brittle and cracked?	Y																			
Does the window frame curve outwards or show other signs of deformation?	Y																			
Are the sash and window frame aligned?	Y																			
Is hardware (screws, bolts, etc) missing from the window frame or sash?	N																			
Do the frame or sash components show decay such as rot or corrosion?	N																			
If the window was originally operable, are the sash or sashes now operable?	N																			
If the window has a counter balance is it operational?	\																			
Does the window sill show signs of rot, cracking or corrosion?	Y																			
Is the sill sloping away from the building?	N																			
IMAGE NO.																				
OVERALL WINDOW CONDITION: [2]	F																			

1. Specify window location as: ① first floor, ② second floor, ③ third floor, or ④ fourth floor AND specify façade on which window is located (north, south, east or west)
2. Indicate weather the overall window unit is in Good (G), Fair (F) or Poor (P) condition. Refer to Evaluation Standards for assistance.

COMMENTS:

GUIDELINES FOR THE REPAIR AND REPLACEMENT OF WINDOWS IN HISTORIC BUILDINGS

Windows in historic buildings may be eligible for replacement if:

- the original windows no longer exist
- the windows are located on a less visible elevation, such as the rear of a building.
- the Window Condition Assessment and corresponding documentation demonstrate the the window is unsalvageable.

WINDOW TYPE

Replacement window types should match the appearance and character of the original window. Best practice dictates that original double-hung windows should only be replaced with new double-hung window units. The sizes of sashes and location of meeting rails should match the original windows. Replacement windows should incorporate any special features of the original windows, such as transom windows. Avoid enlarging window openings or closing them off. Maintain or, if necessary, recover the historic size and shape of all window openings; neither expand the openings nor fill them in, except to make good previous damaging modifications. If interior ceilings are to be lowered with a suspended ceiling or furred down with a false ceiling, ensure that the ceiling drop is set back sufficiently from the windows to enable their visual and functional continuity.

WINDOW FRAMES

Replacement window frames for wooden windows should be of wood construction or of an approved substitute material (See Substitute Materials page 12). Dimensions should match the original windows. Any decorative detailing on the original windows (such as brick mold, lintels, sills and casings) should be accurately duplicated.

SASHES

Replacement sash for wooden windows should be of wooden construction and dimensions should match the original windows. Any decorative detailing on the original sashes (such as muntins, mullions and sash frames) should be accurately duplicated. The sizes of the sash and location of the meeting rails should match the original windows. The upper and lower sash should be on separate planes to match original sash windows. If the window sash is badly deteriorated, replacement units can be made to fit the existing frame (See Substitute Materials page 11). Replacement for metal windows should be of metal construction. Replacement windows should incorporate any special features of the original windows.

MUNTINS

Replacement muntins should appear on the outside of the window and, preferably, on the inside as well. Muntins attached to the inside of the window or between inside and outside panes of glass are not acceptable. The following muntin replacement techniques are listed in descending order of acceptability:

- true muntins that actually support the glass and extend from the exterior to the interior of the window, providing that the dimensions and profiles of the original muntins can be reproduced
- muntins that match the dimensions and profile of the original muntins but applied to the interior and exterior surface of a sealed window unit
- as above but applied only to the exterior of the sealed window unit
- never add muntins or the appearance of muntins to windows that were originally composed of large sheets of glass.

GLASS

Retain historic glass and protect it during repairs. If glass is cracked or missing, new glass panes can be installed. Cracks smaller than 1" may be monitored and

not replaced. Replacement glass should be clear and without tint or mirror-finish. If necessary, Low-E films are acceptable. Laminated security glass is a superior solution to unsightly security grilles or bars, which make maintenance and cleaning more difficult. Clean glass with detergent on rags or newspaper. If there is a considerable build-up of grime, use the finest steel wool available. Rinse off with water. Polish the glass with chamois, linen or powdered chalk.

FINISHES

Exterior finishes should match the original window colours (confirm through on-site investigations, historic research and archival photographs). If the original colours cannot be recovered, repaint in suitable colours that are authentic to the period of the building. The following exterior finish materials are listed in descending order of acceptability:

- paint/stain finish to match original colours
- factory applied paint finish to match original colours
- aluminium clad wooden window frames with a factory finish to match original colours
- aluminium clad wooden window frames with a finish sympathetic to original colours

SUBSTITUTE MATERIALS

Substitute materials will only be considered in circumstances where the appearance is virtually indistinguishable from the original and there is a significant advantage in terms of the availability, cost, performance or durability. Wherever possible, windows that are visually accessible should be made of the same material and visual quality to match the original. Aluminum or fibreglass may be a suitable replacement for a historic wood sash provided the detail of the historic window can be matched. Replacement window frames for steel windows may be of aluminium or fibreglass.

BLIND WINDOWS

If windows must be blocked because of a major functional change, first consider changing the interior layout and, secondarily, look for Building Code alternatives to accommodate the use of the window in its historic form and location. If, as a last resort, windows must be covered over from the interior, maintain their exterior appearance as windows. Maintain or if necessary recover the historic size and shape of all window openings. Removing a window is not acceptable.

WEATHERSTRIPPING

The most dramatic and cost-effective improvements are achieved not through replacing windows but by reducing air infiltration (i.e. sealing fixed joints and installing weatherstripping). Weatherstripping should be flexible and spring back to its original shape. Spring bronze is an excellent choice for weatherstripping windows as it is durable and easy to install.

STORM WINDOWS

If wooden storm windows exist they should be kept painted and in good repair. If you have single pane wooden windows, consider adding wood storms to increase energy efficiency. Interior storms are also a good alternative; they are less visible and often cheaper than exterior storms and can be made to fit on the sash or the window trim. Aluminum storms and screens are not recommended because they obscure the original windows. However, they maybe acceptable in special circumstances. Consult with your designation authority. Clip-on plastic muntins are inappropriate and should not be used.

HARDWARE (SASH LOCKS, SASH COUNTERWEIGHTS, SASH HOLDS, ETC.)

Wherever possible:

- salvage, repair and clean original hardware and reuse on the replacement frames
- select new hardware that is appropriate to the era of the building

REPLACEMENT WINDOWS

If the degree of deterioration necessitates the replacement of windows, authentic replacement units are recommended. Replacement windows should match the original windows in terms the size, shape, material, proportions, profiles, reveal and glazing type of the original window. It is important that every effort be made to match the style, muntin grids, size and profiles of elements. Blocking up a window, that is, removing the sash and frame and filling in the opening, should never be considered on a primary façade or visible side elevation. Replacement of windows on primary or secondary building elevations is not recommended. However, the back of the building is traditionally an area that allows flexibility. Original appearance, dimensions and detailing should be confirmed through:

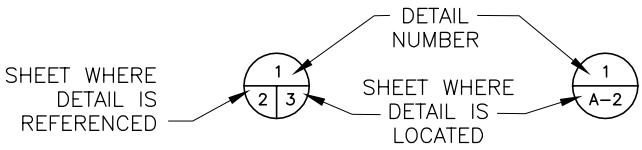
- remnants of the original windows
- archival photographs
- original architectural drawings

For more information on the *Guidelines for the Repair or Replacement of Windows in Historical Buildings* or the *Windows Condition Assessment* please contact:

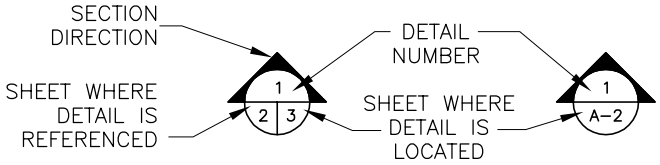
City of Winnipeg
Planning & Land Use Division, Heritage Building Unit
Planning, Property and Development Department
15 - 30 Fort Street
Winnipeg, MB R3C 4X5
tel: 204-986-4722
fax: 204-986-7524
www.winnipeg.ca/historicalbuildings

Province of Mantitoba
Historic Resources Branch
Manitoba Culture, Heritage, Tourism and Sport
Main Floor, 213 Notre Dame Ave.
Winnipeg, MB R3B 1N3
tel: 204-945-5809
toll free: 1-800-282-8069-2205
fax: 204-948-2384
www.manitoba.ca/heritage

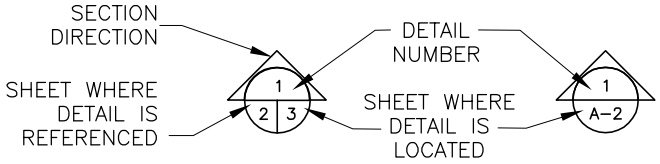
DETAIL BUBBLES



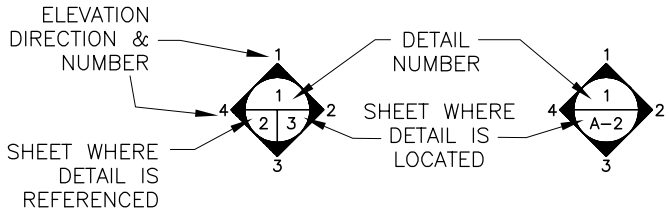
BUILDING SECTIONS



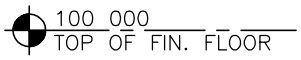
WALL SECTIONS



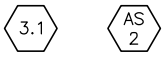
INTERIOR ELEVATIONS



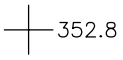
BUILDING ELEVATIONS



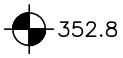
SPECIFICATION DETAILS



EXISTING SITE ELEVATION

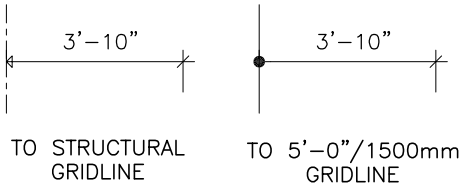


NEW SITE ELEVATION



WALL / ROOF / FLOOR CONSTRUCTION TYPE

DIMENSION TYPES



OCTOBER 2008

TYPICAL DRAWING SYMBOLS LEGEND

mcm architects inc.

141 st. anne's road, winnipeg, manitoba, R2M 2Z3

158-8th street, brandon, manitoba, R7A 3X1

I-M

1.0

SHOWERS

MOUNTING HEIGHTS ARE MEASURED FROM THE FINISHED SHOWER FLOOR TO THE UNDERSIDE OF THE SHOWER HEAD AT THIRTY (30) DEGREES. THE MIXING VALVE SHALL BE LOCATED 1070mm (3'–6") TO THE CENTER LINE OF THE VALVE ABOVE THE FINISHED SHOWER FLOOR.

1) NORMAL INSTALLATION	1980mm (6'–6")
2) BARRIER–FREE SHOWER STALL	REFER TO SPEC DETAIL 9.8

URINALS

URINAL MOUNTING HEIGHTS ARE MEASURED FROM THE FINISHED FLOOR TO THE RIM OF THE BOWL UNLESS NOTED OTHERWISE.

1) NORMAL INSTALLATION	610mm (24")
2) ELEMENTARY	410mm (16")
3) KINDERGARTEN/DAYCARE	350mm (14")
4) BARRIER–FREE/JUNIOR HIGH	510mm (20")

WALL HUNG DRINKING FOUNTAINS

DRINKING FOUNTAIN MOUNTING HEIGHTS ARE MEASURED FROM THE FINISHED FLOOR TO THE SPOUT OPENING UNLESS NOTED OTHERWISE.

1) NORMAL INSTALLATION	1015mm (40")
2) ELEMENTARY/JUNIOR HIGH	815mm (32")
3) KINDERGARTEN/DAYCARE	660mm (26")
4) BARRIER–FREE	815mm (32")

WALL HUNG LAVATORIES

LAVATORY MOUNTING HEIGHTS ARE MEASURED FROM THE FINISHED FLOOR TO THE RIM OF THE BOWL UNLESS NOTED OTHERWISE.

REFER TO SPECIFICATION DETAIL 6.6 FOR TYPICAL LAVATORY SINK MOUNTED IN VANITY COUNTER.

1) NORMAL INSTALLATION	840mm (33")
2) ELEMENTARY	760mm (30")
3) KINDERGARTEN/DAYCARE	660mm (26")
4) BARRIER–FREE	815mm (32")

GENERAL NOTES – ALL FIXTURES

1) COORDINATE ALL BARRIER–FREE FIXTURE MOUNTING HEIGHTS WITH FIXTURE MANUFACTURER'S SPECIFICATIONS TO ENSURE CLEARANCES ARE COMPLIANT WITH LOCAL BUILDING CODE REQ'S.

2) MOUNTING HEIGHTS INDICATED ARE RECOMMENDATIONS ONLY; CONTRACTOR SHALL VERIFY ALL MOUNTING HEIGHTS BY LOCATION WITH CONSULTANT PRIOR TO INSTALLATION.

AUG 2010

FIXTURE HEIGHT ROUGH-IN SCHEDULE

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I–M

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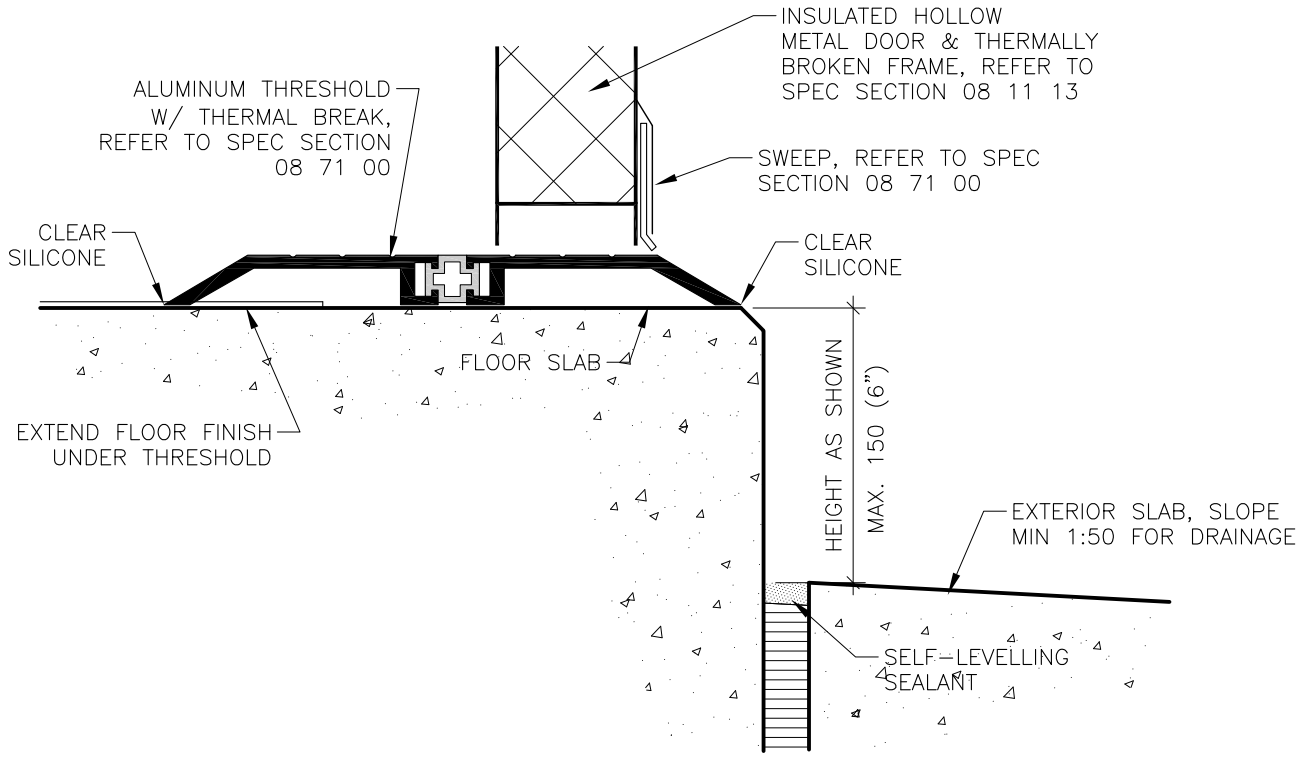

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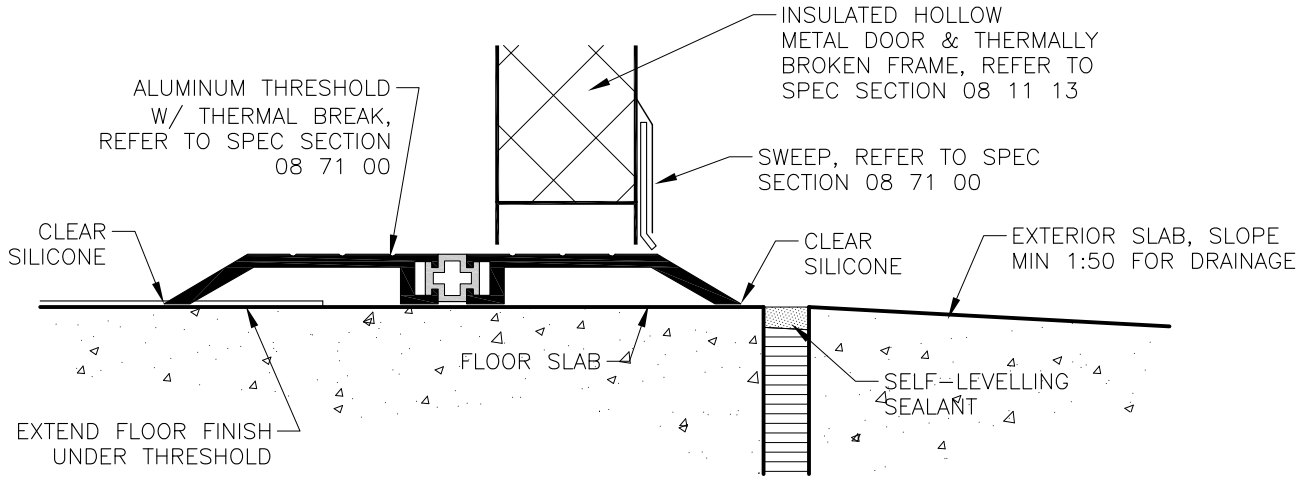

B

JUN 2015

EXTERIOR DOOR THRESHOLD DETAILS

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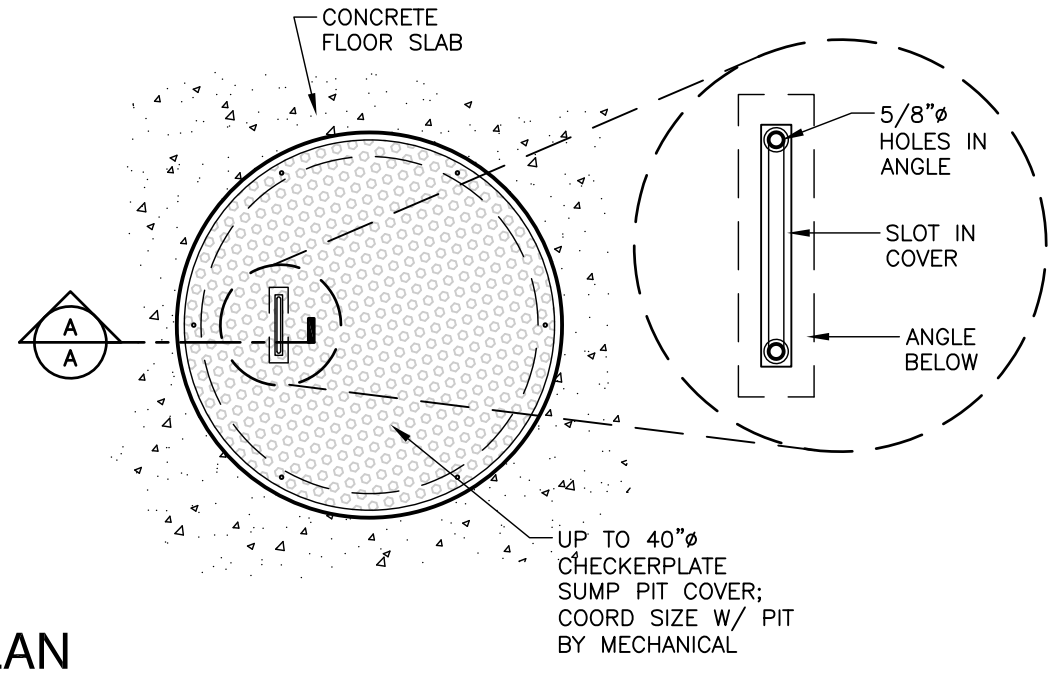
I-M

3.1



PLAN

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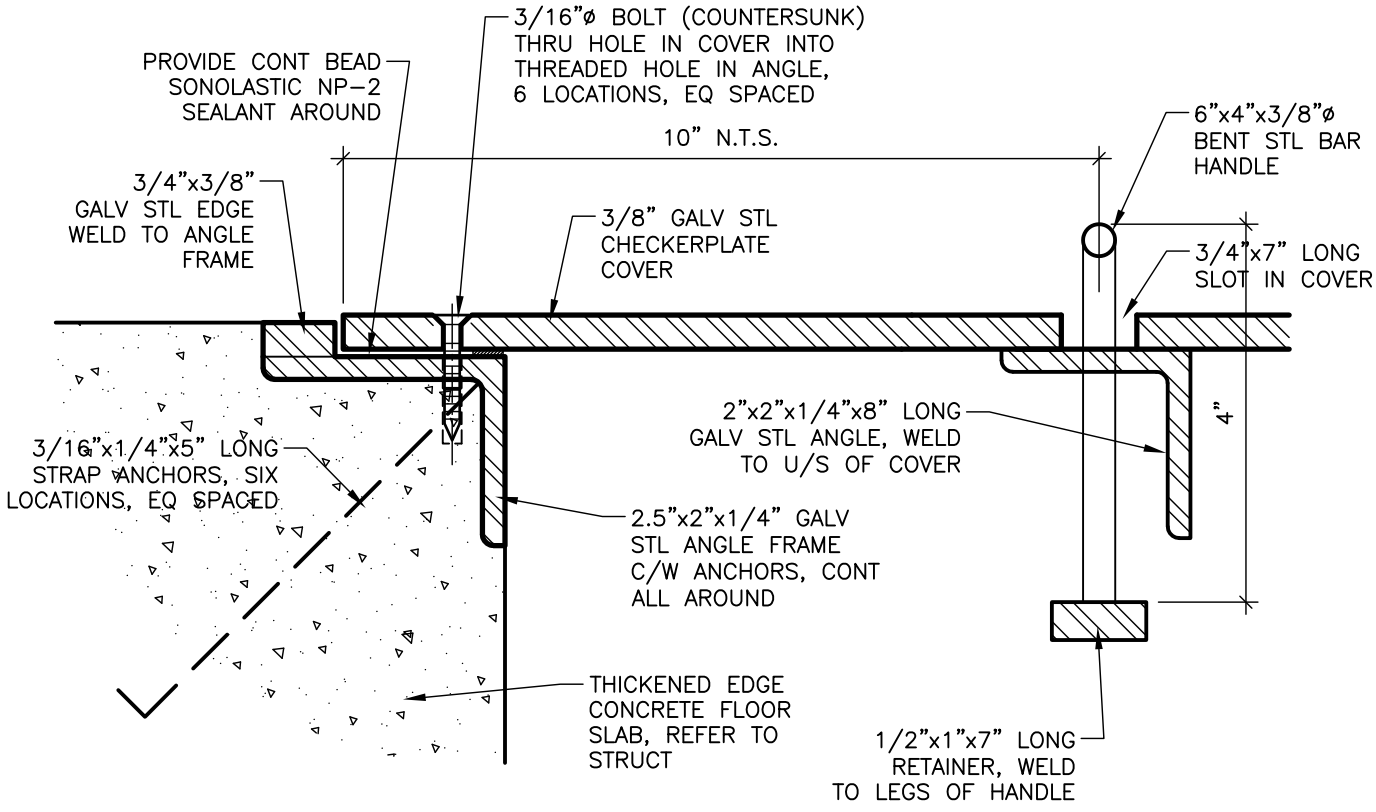

SECTION 'AA'

SCALE 1:2

22 OCT 2024

CHECKERPLATE SUMP PIT COVER C/W HANDLE

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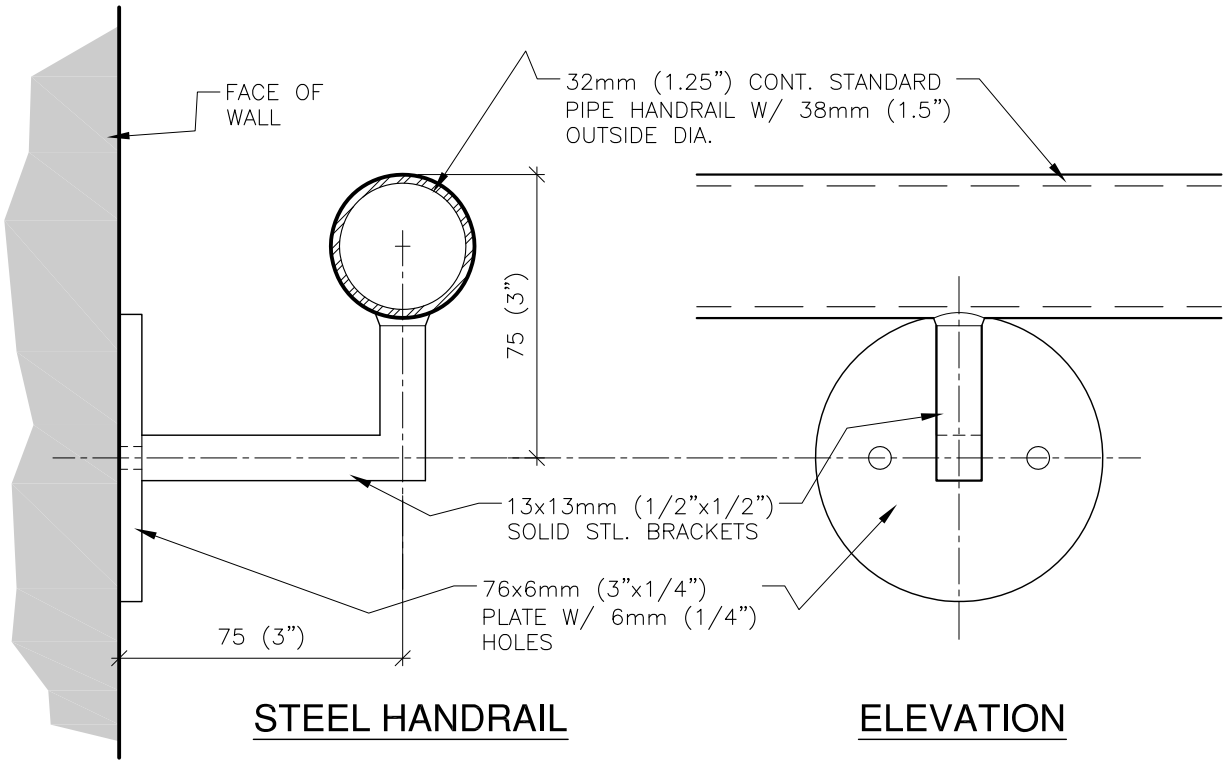
2624

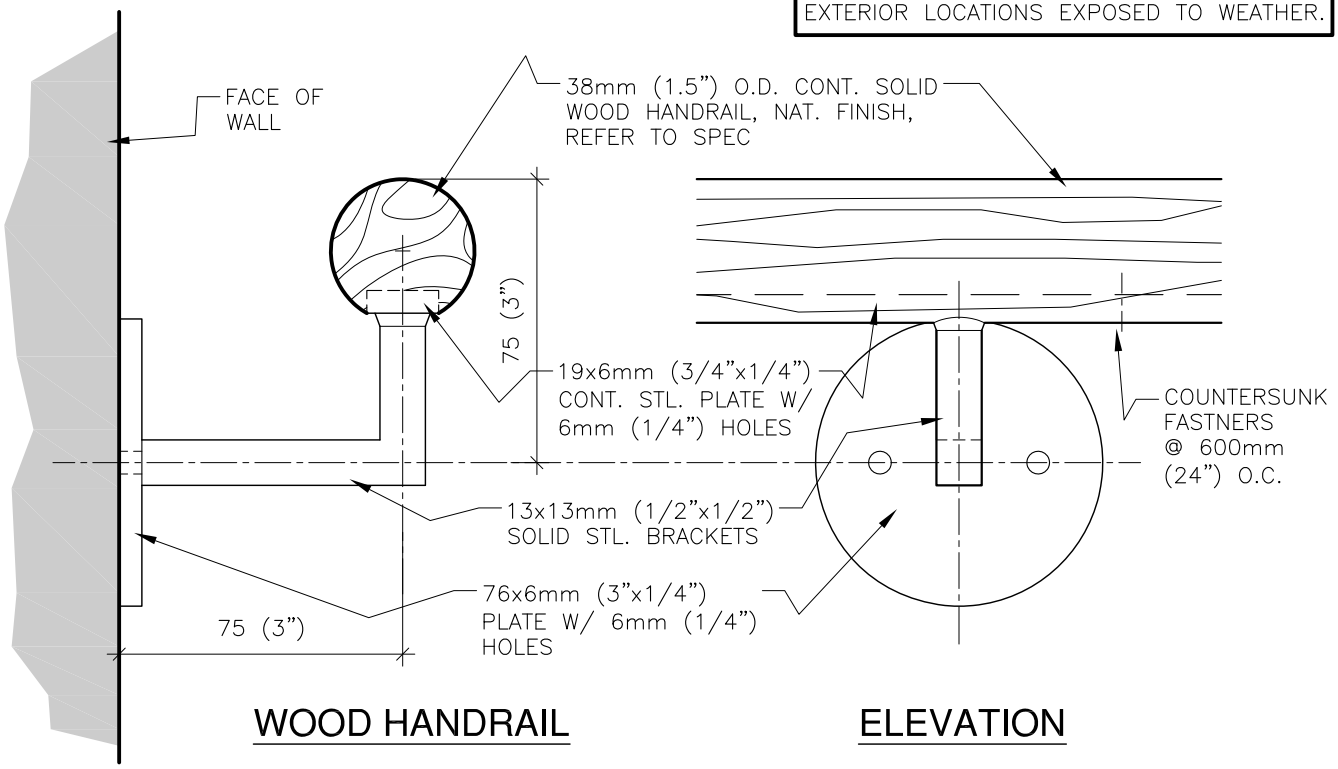
5.5



STEEL HANDRAIL ELEVATION

GRIND ALL WELDS SMOOTH, PAINT FINISH.

USE GALV. STEEL PIPE & BRACKETS AT ALL EXTERIOR LOCATIONS EXPOSED TO WEATHER.



WOOD HANDRAIL ELEVATION

MARCH 2013

WALL MOUNTED HANDRAILS

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I—M

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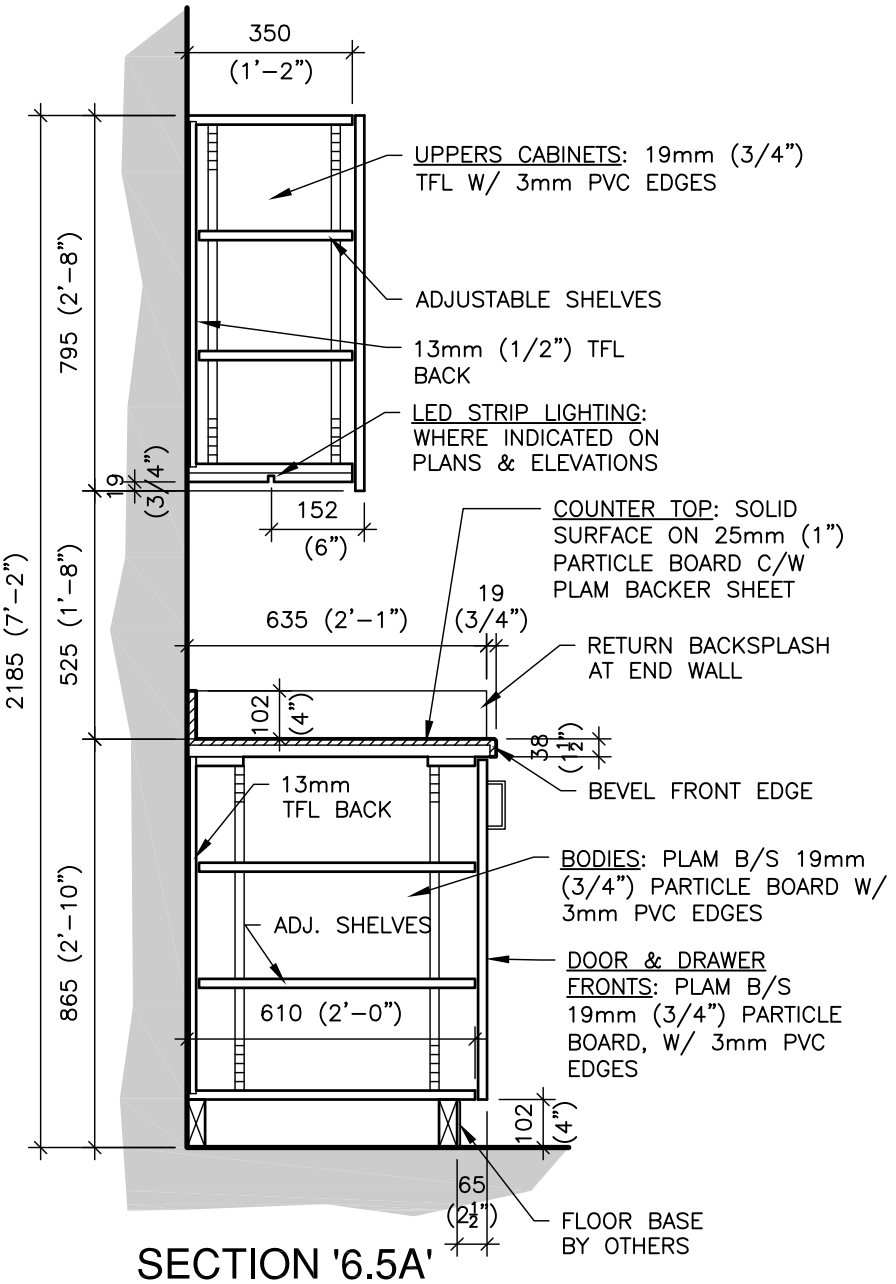

SECTION '6.5A'

Scale: 1:16

TYPICAL MILLWORK CONSTRUCTION:

REFER TO SPEC SECTION 06 41 00 FOR ADDITIONAL INFORMATION ON MILLWORK CONSTRUCTION, FINISHES & HARDWARE.

KICKBOARDS & BASES IN CONTACT WITH FLOOR: MIN. 25mm (1") PLYWOOD OR SOLID WOOD BASE.

LOWER CABINETS, EXPOSED: PLASTIC LAMINATE ON 19mm (3/4") PARTICLE BOARD (BOTH FACES) C/W 3mm PVC, ALL EXPOSED EDGES.

LOWER CABINETS, CONCEALED: 19mm (3/4") TFL C/W 1mm PVC, ALL EDGES.

UPPER CABINET INCLUDING DOORS: 19mm (3/4") TFL C/W 3mm PVC, ALL EXPOSED EDGES.

CABINET BACKS: 13mm (1/2") TFL, SET 16mm (5/8") INTO CASE BODY.

ADJUSTABLE SHELVES, UP TO 800mm (32") WIDE: PLASTIC LAMINATE ON 19mm (3/4") PARTICLE BOARD C/W 3mm PVC FRONT & BACK EDGES, 1mm PVC SIDE EDGES.

ADJUSTABLE SHELVES, UP TO 1065mm (42") WIDE: 25mm (1") TFL W/ 3mm PVC FRONT & BACK EDGES, 1mm PVC SIDE EDGES.

DRAWERS: 13mm (1/2") TFL INCLUDING SUB–FRONT & BOTTOM C/W 1mm PVC EDGES.

DOOR & DRAWER FRONTS: PLASTIC LAMINATE ON 19mm (3/4") PARTICLE BOARD C/W 3mm PVC, ALL EDGES.

COUNTER TOPS, DRY AREAS: 13mm (1/2") SOLID SURFACE ON 25mm (1") PARTICLE BOARD C/W PLAM BACKER SHEET.

COUNTER TOPS, WET AREAS: 13mm (1/2") SOLID SURFACE ON 25mm (1") MOISTURE–RESISTANT PARTICLE BOARD C/W PLAM BACKER SHEET.

BACKSPLASH: 13mm (1/2") SOLID SURFACE.

LED STRIP LIGHTING, WHERE INDICATED: RECESSED 13x13mm (1/2"X1/2") DEEP SLOT IN 38mm (1–1/2") THICK BOTTOM SHELF; COORDINATE W/ ELECTRICAL.

MAR 2024

TYPICAL KITCHEN MILLWORK & UPPER CABINETS

mcm architects inc.

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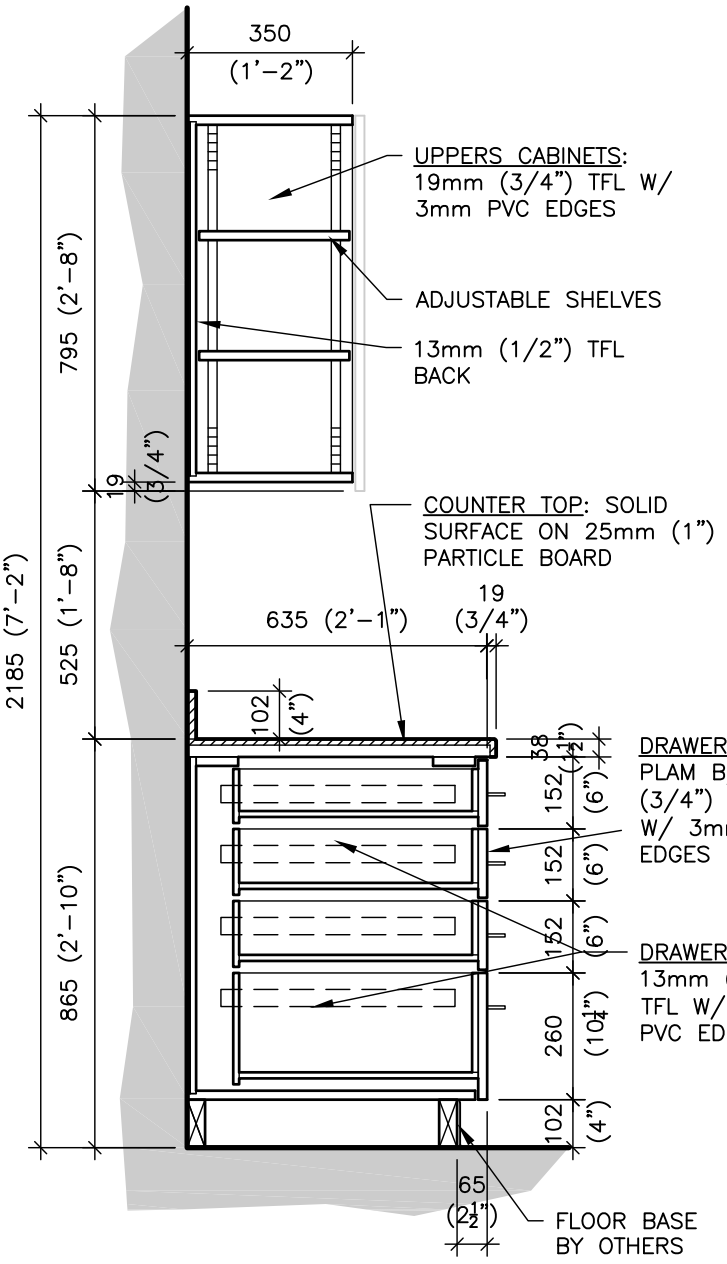
260 - 8th street, brandon, manitoba, R7A 3X3

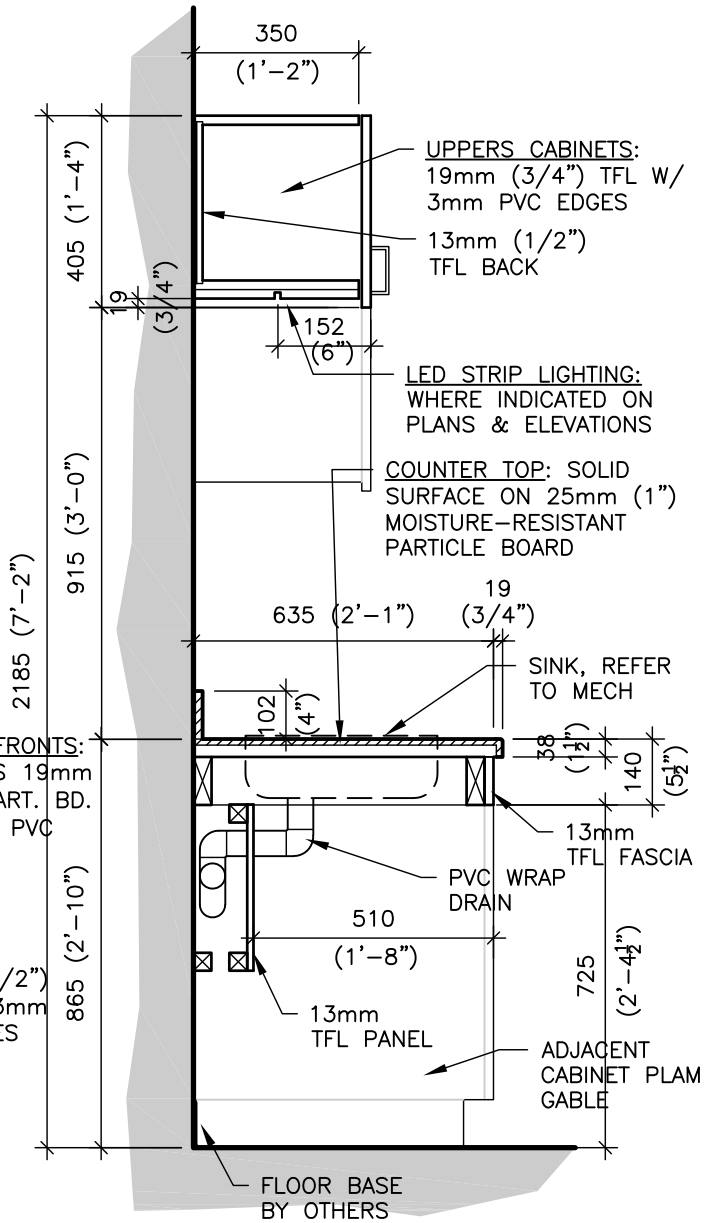
2624

6.5A



SECTION '6.5B'

Scale: 1:16



SECTION '6.5C'

Scale: 1:16

REFER TO SPEC DETAIL 6.5A AND SPEC SECTION 06 41 00 FOR ADDITIONAL INFORMATION ON MILLWORK CONSTRUCTION, FINISHES & HARDWARE.

MAR 2024

TYPICAL KITCHEN MILLWORK & UPPER CABINETS

mcm architects inc.

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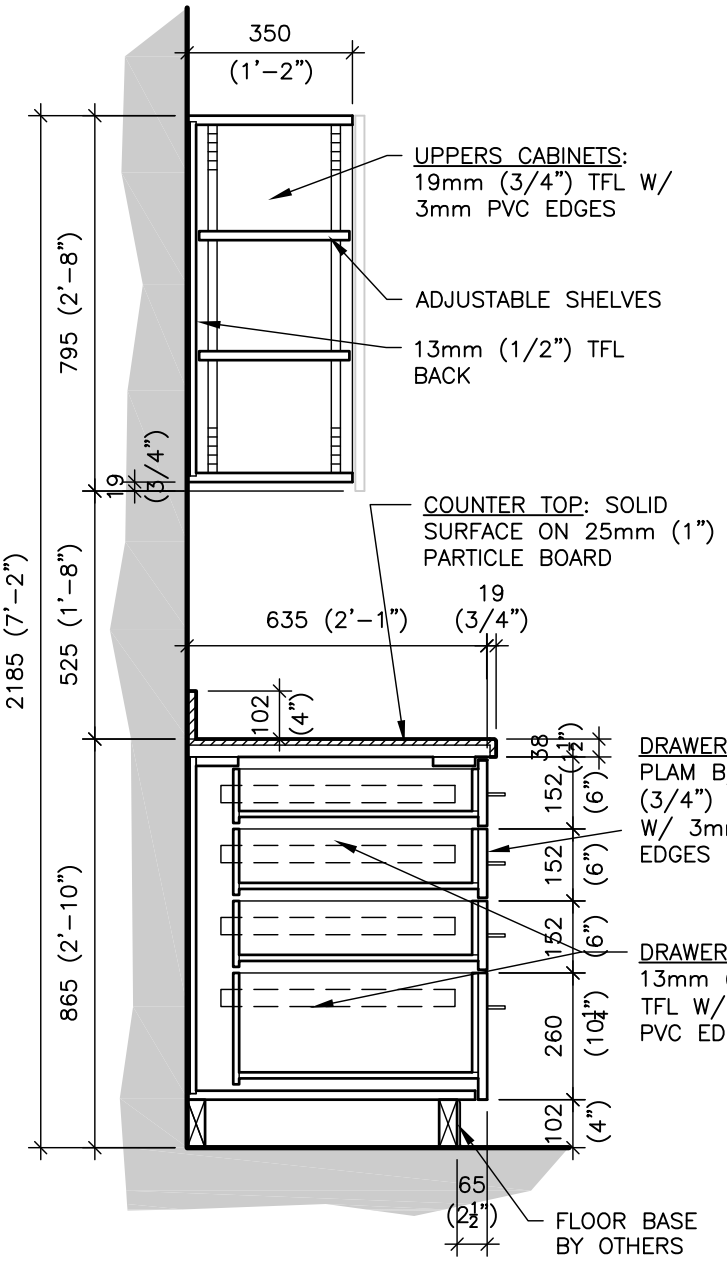
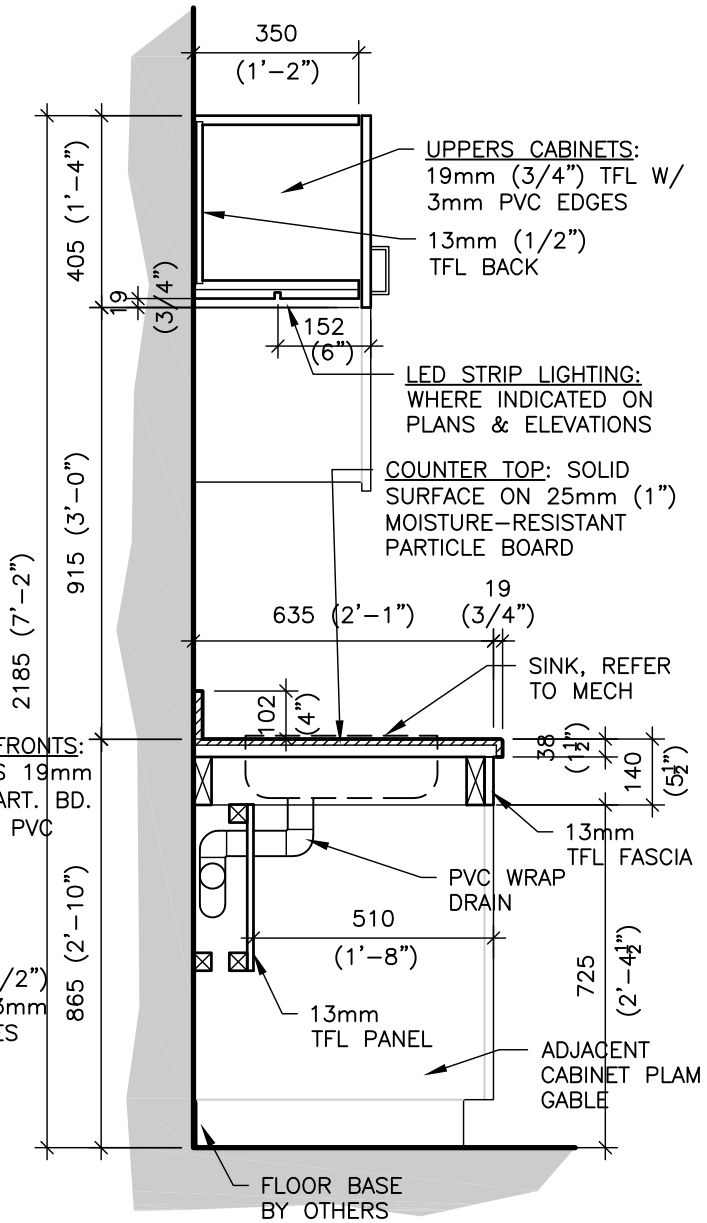
2624

6.5B+C



SECTION '6.5B'

Scale: 1:16



SECTION '6.5C'

Scale: 1:16

REFER TO SPEC DETAIL 6.5A AND SPEC SECTION 06 41 00 FOR ADDITIONAL INFORMATION ON MILLWORK CONSTRUCTION, FINISHES & HARDWARE.

MAR 2024

TYPICAL KITCHEN MILLWORK & UPPER CABINETS

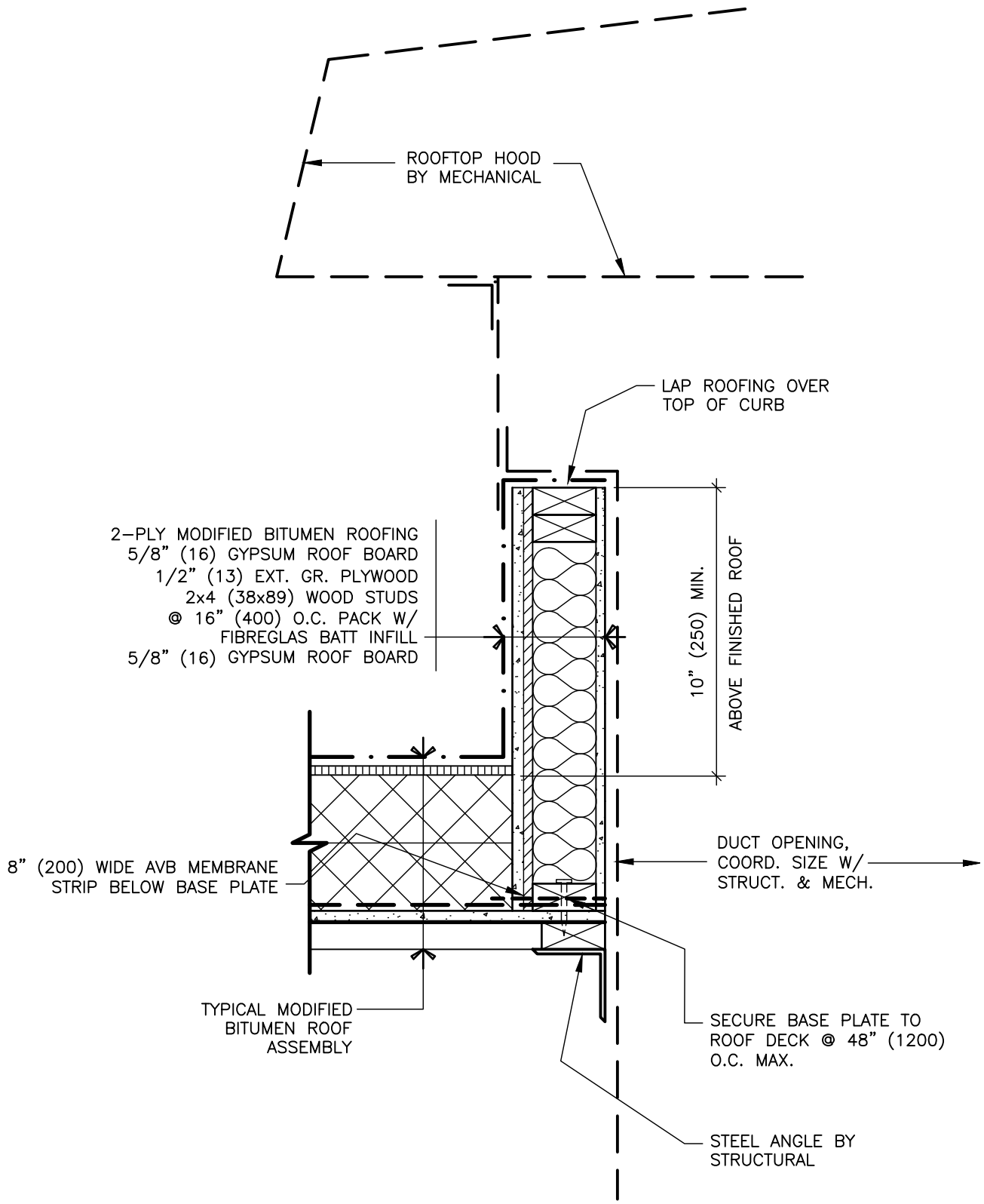
mcm architects inc.

141 st. anne's road, winnipeg, manitoba, R2M 2Z3

260 - 8th street, brandon, manitoba, R7A 3X3

2624

6.5B+C



SCALE : 1–1/2" = 1'–0"

MAR 2019

TYPICAL FAN / VENTILATOR CURB

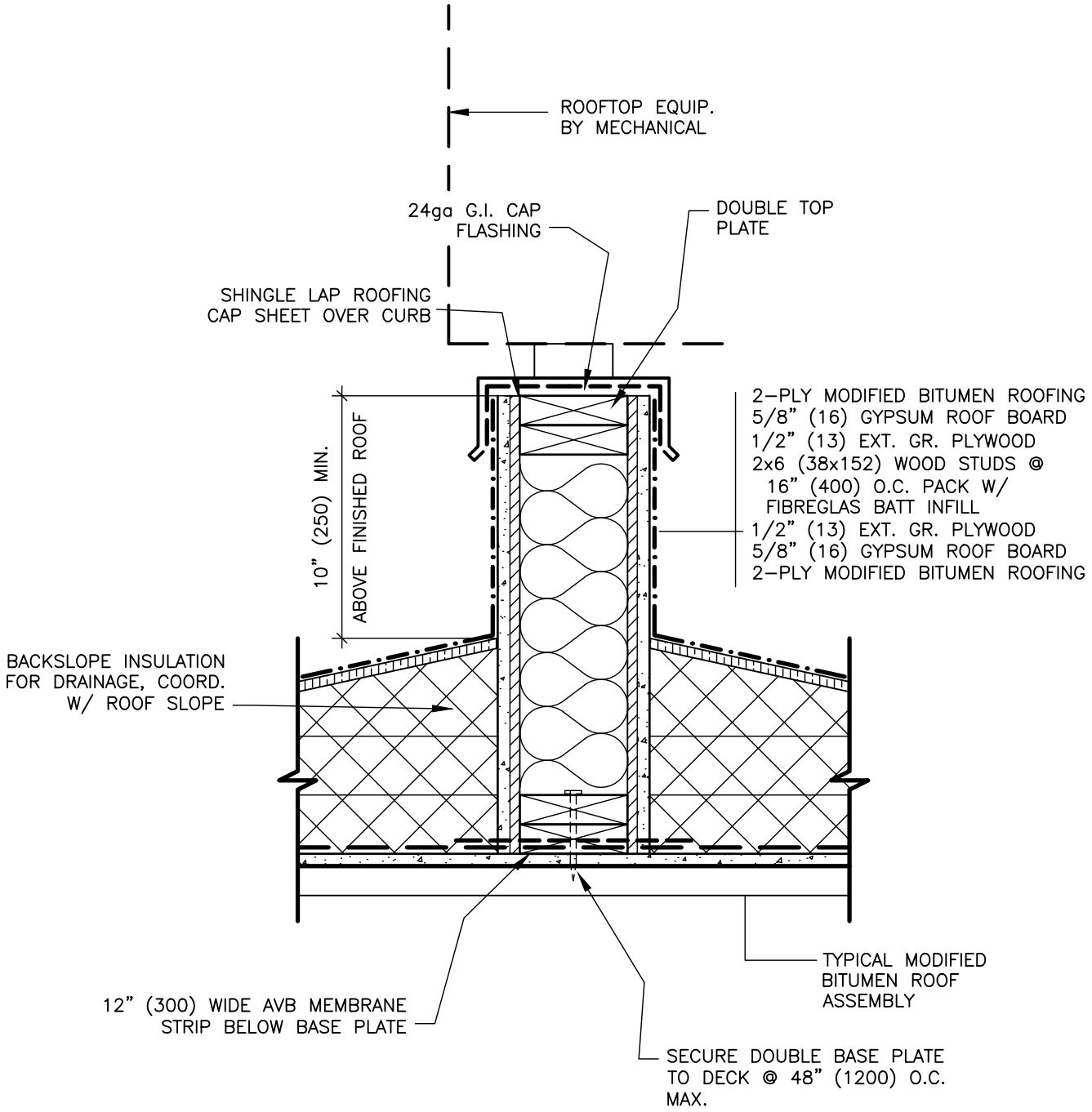
mcm architects inc.

141 st. anne's road, winnipeg, manitoba, R2M 2Z3

260 - 8th street, brandon, manitoba, R7A 3X3

I–M

7.4



SCALE : 1-1/2" = 1'-0"

MAR 2019

TYPICAL ROOF SLEEPER CURB

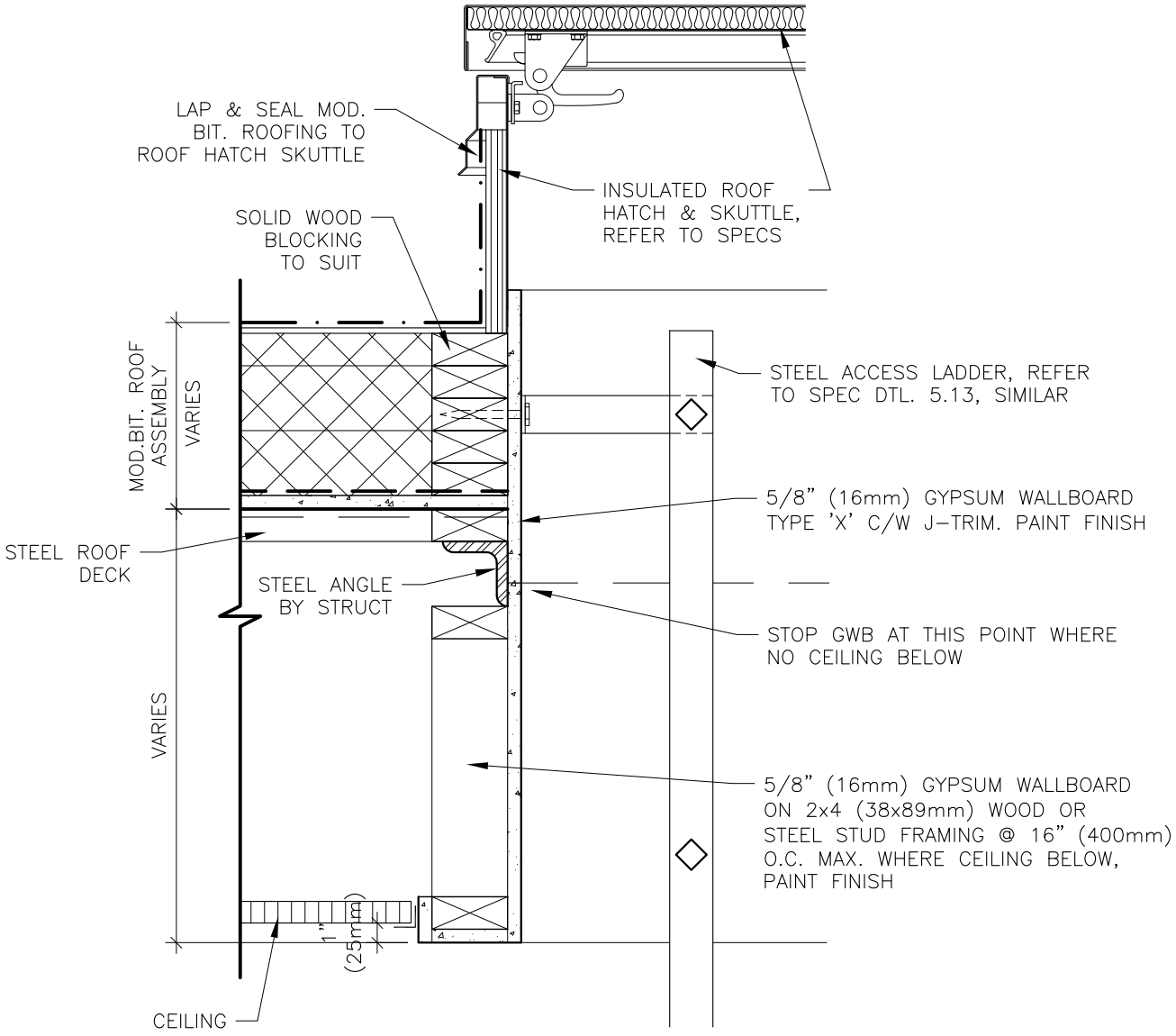
mcm architects inc.

141 st. anne's road, winnipeg, manitoba, R2M 2Z3

260 - 8th street, brandon, manitoba, R7A 3X3

I-M

7.5



SCALE: 1-1/2"=1'-0"

JUN 2015

TYPICAL ROOF HATCH+SKUTTLE

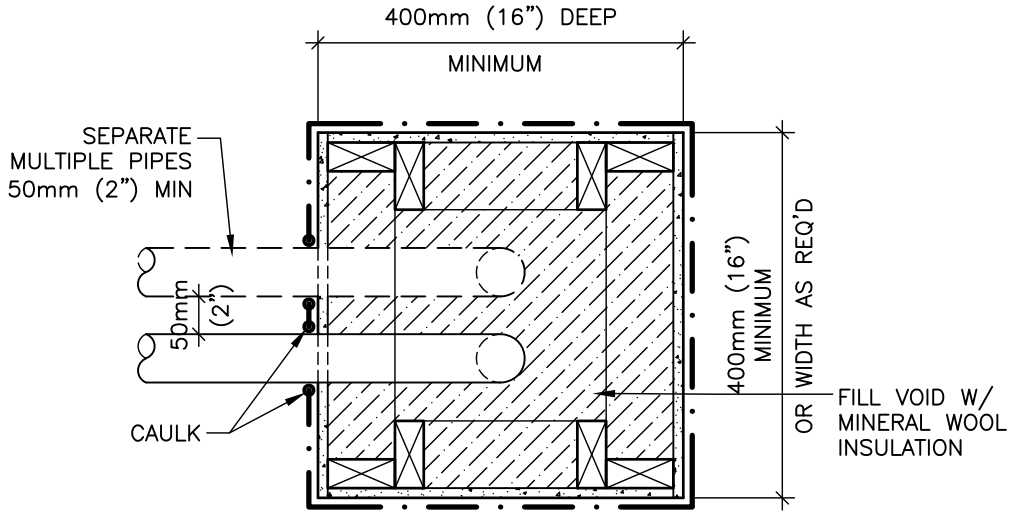
mcm architects inc.

141 st. anne's road, winnipeg, manitoba, R2M 2Z3

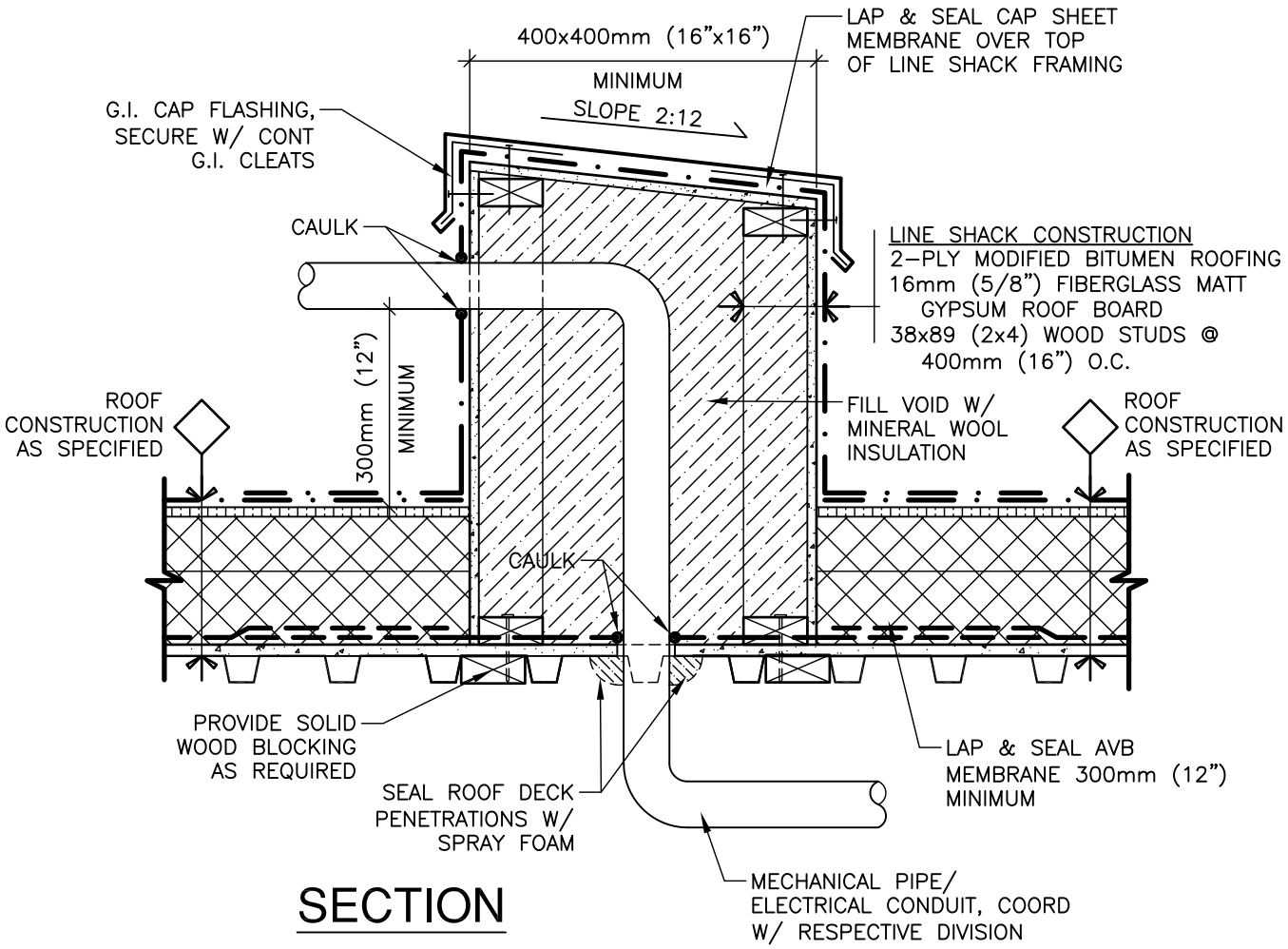
158-8th street, brandon, manitoba, R7A 3X1

I-M

7.8



PLAN



SECTION

SCALE 1:10

15 JAN 2025

TYPICAL ROOFTOP LINE SHACK

mcm architects inc.

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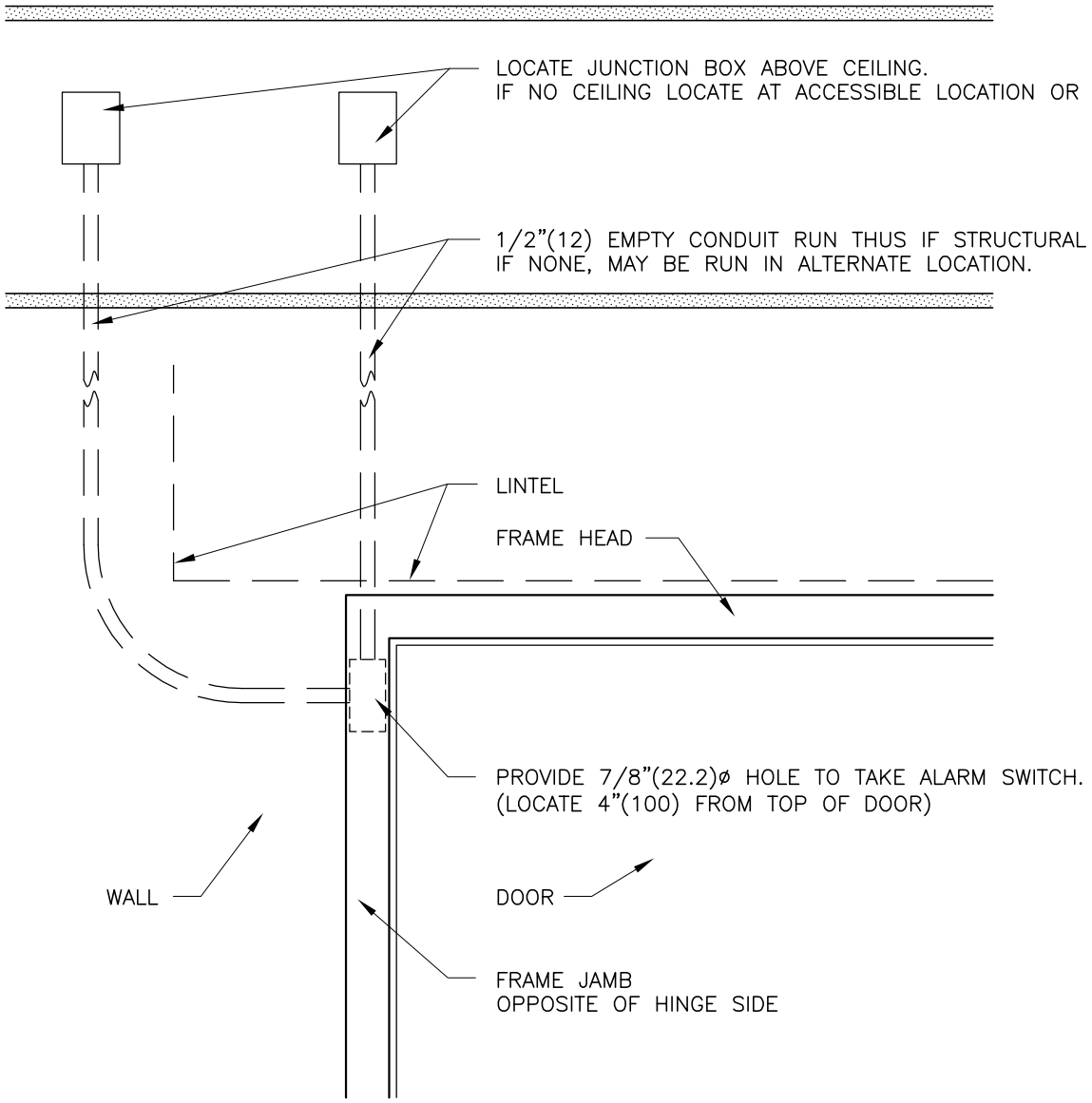
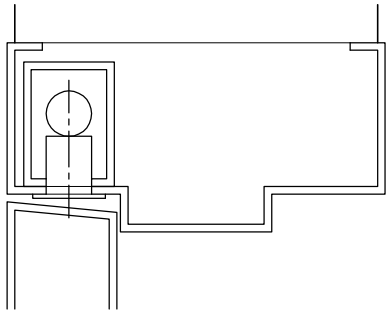
260 - 8th street, brandon, manitoba, R7A 3X3

I–M

7.11



ELEVATION



HOR. SECTION: JAMB

DECEMBER 2003

HOLLOW METAL FRAME: INTRUSION ALARM INSTALLATION

mcm architects inc.

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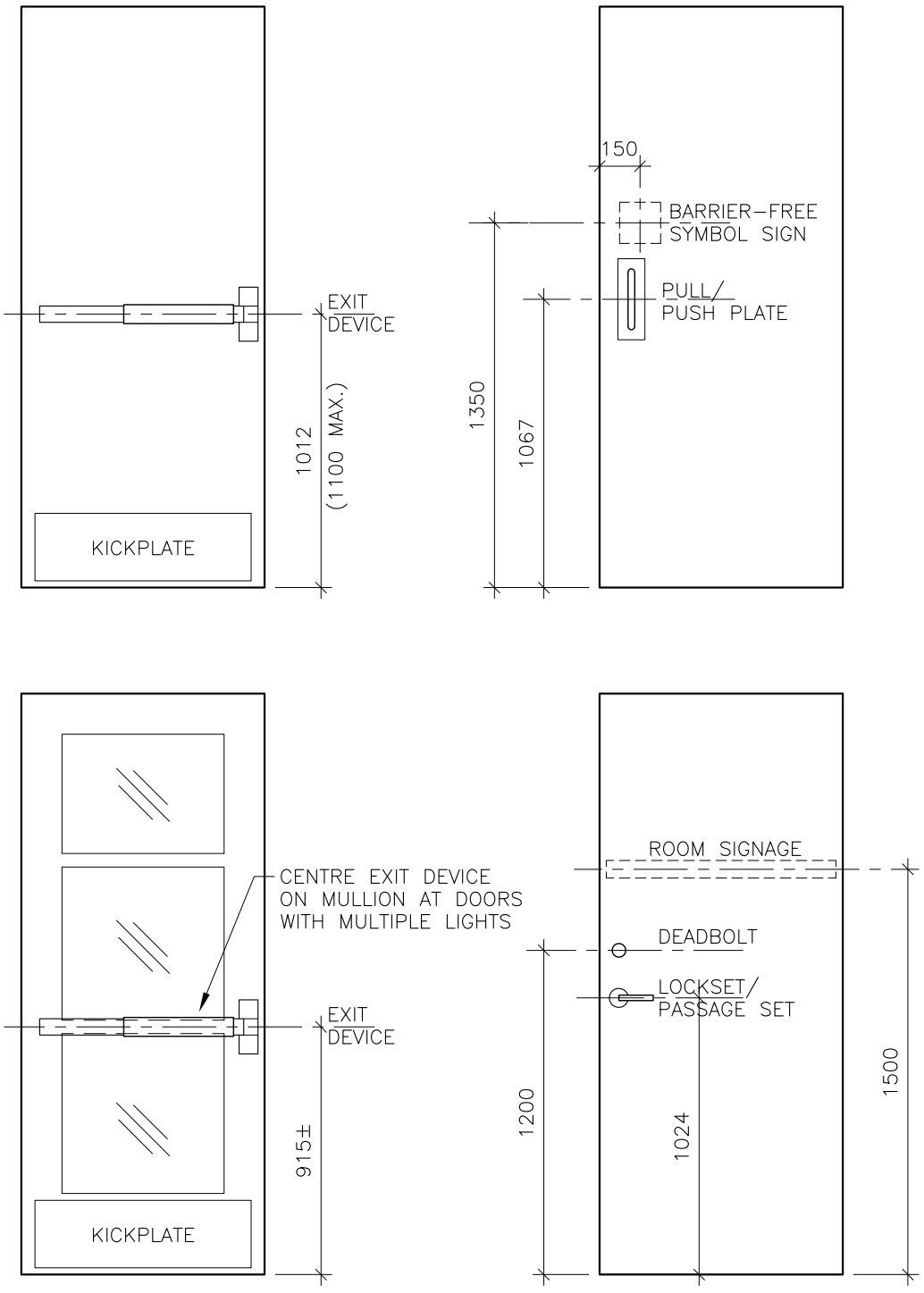
158-8th street, brandon, manitoba, R7A 3X1



MOUNTING HEIGHTS ARE TYPICAL AND SHALL BE MAINTAINED UNLESS NOTED OTHERWISE ON DRAWINGS OR SPECIFICATIONS. GENERAL CONTRACTOR SHALL COORDINATE INSTALLATION WITH OWNER & SUBTRADES.

REFER TO SECTION 08 71 00 FOR DOOR & FRAME SCHEDULE AND FINISH HARDWARE SPECIFICATIONS.

REFER TO SECTION 10 95 00 FOR BARRIER–FREE & ROOM SIGNAGE.

JUN 2015

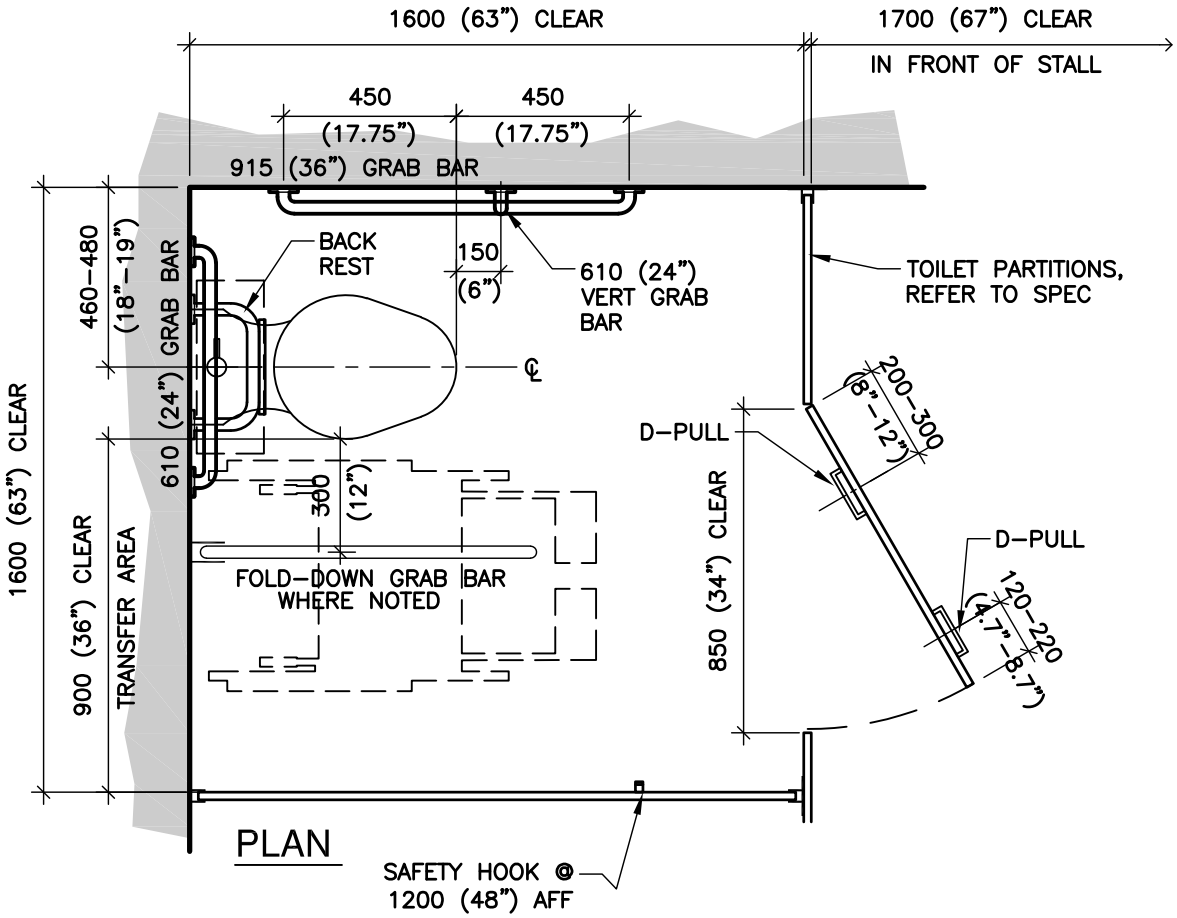
TYPICAL FINISH HARDWARE MOUNTING HEIGHTS

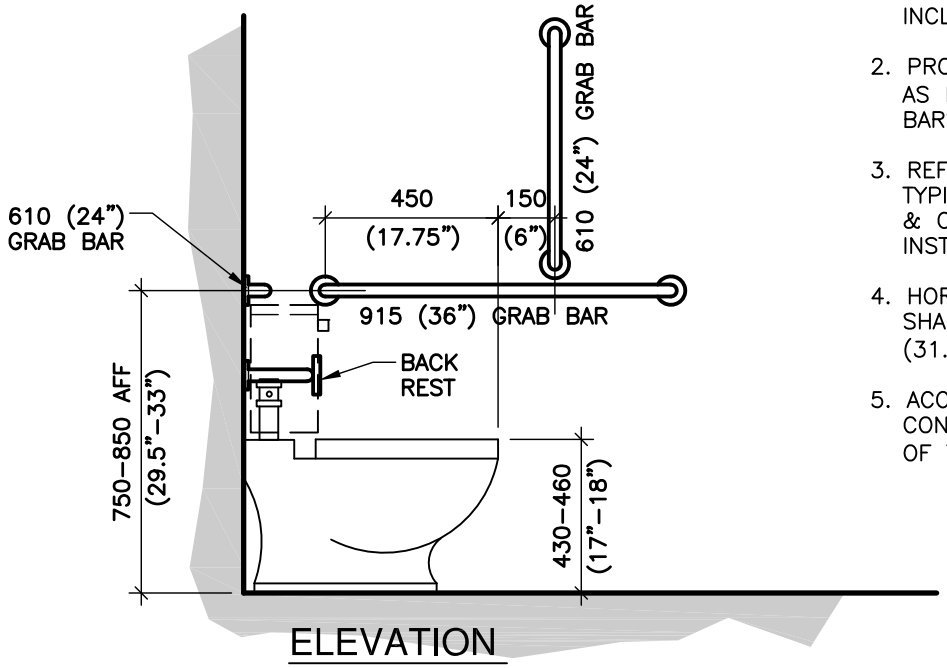
mcm architects inc.

141 st. anne's road, winnipeg, manitoba, R2M 2Z3

158 - 8th street, brandon, manitoba, R7A 3X1

METRIC





GENERAL NOTES:

1. REFER TO SPEC SECTION 10 95 00 FOR ALL WASHROOM ACCESSORIES INCLUDING GRAB BARS.
2. PROVIDE SOLID BLOCKING IN WALLS AS REQ'D FOR MOUNTING OF GRAB BARS, PARTITIONS & ACCESSORIES.
3. REFER TO SPEC DETAIL 1.1 FOR TYPICAL FIXTURE MOUNTING HEIGHTS & CONFIRM WITH OWNER PRIOR TO INSTALLATION.
4. HORIZONTAL D–PULLS FOR STALL DOOR SHALL BE MOUNTED 800–1000mm (31.5"–39") ABOVE FINISH FLOOR.
5. ACCESSIBLE TOILET STALLS SHALL BE IN CONFORMANCE WITH SECTION 3.8.3.12 OF THE 2020 NBC/2024 MBC.

MAR 2024

ACCESSIBLE TOILET STALL (WADS) - GRAB BAR LOCATIONS

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2624

10.6

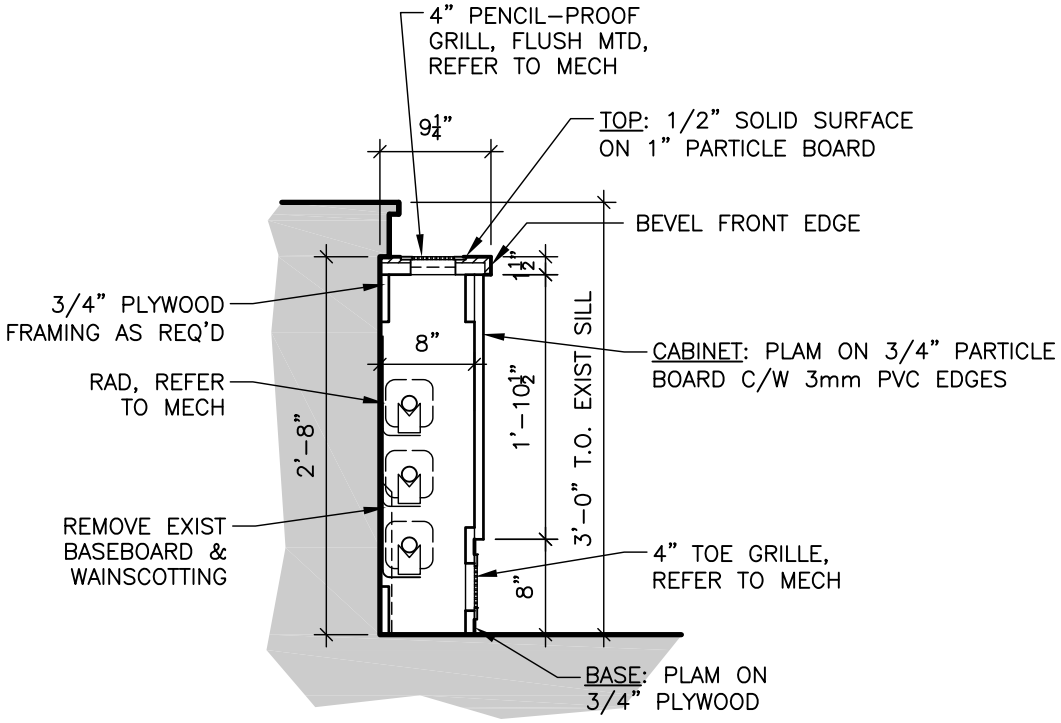
TYPICAL CONSTRUCTION:

REFER TO SPEC SECTION 06 41 00 FOR ADDITIONAL INFORMATION ON MILLWORK CONSTRUCTION, FINISHES & HARDWARE.

KICKBOARDS & BASES IN CONTACT WITH FLOOR: MIN. 25mm (1") PLYWOOD OR SOLID WOOD BASE C/W PLAM FINISH.

CABINETS: PLASTIC LAMINATE ON 19mm (3/4") PARTICLE BOARD C/W 3mm PVC, ALL EXPOSED EDGES.

TOPS: 13mm (1/2") SOLID SURFACE ON 25mm (1") PARTICLE BOARD C/W PLAM BACKER SHEET.



SECTION .

Scale: 1:16

MAR 2024

PERIMETER RADIATION CHASE

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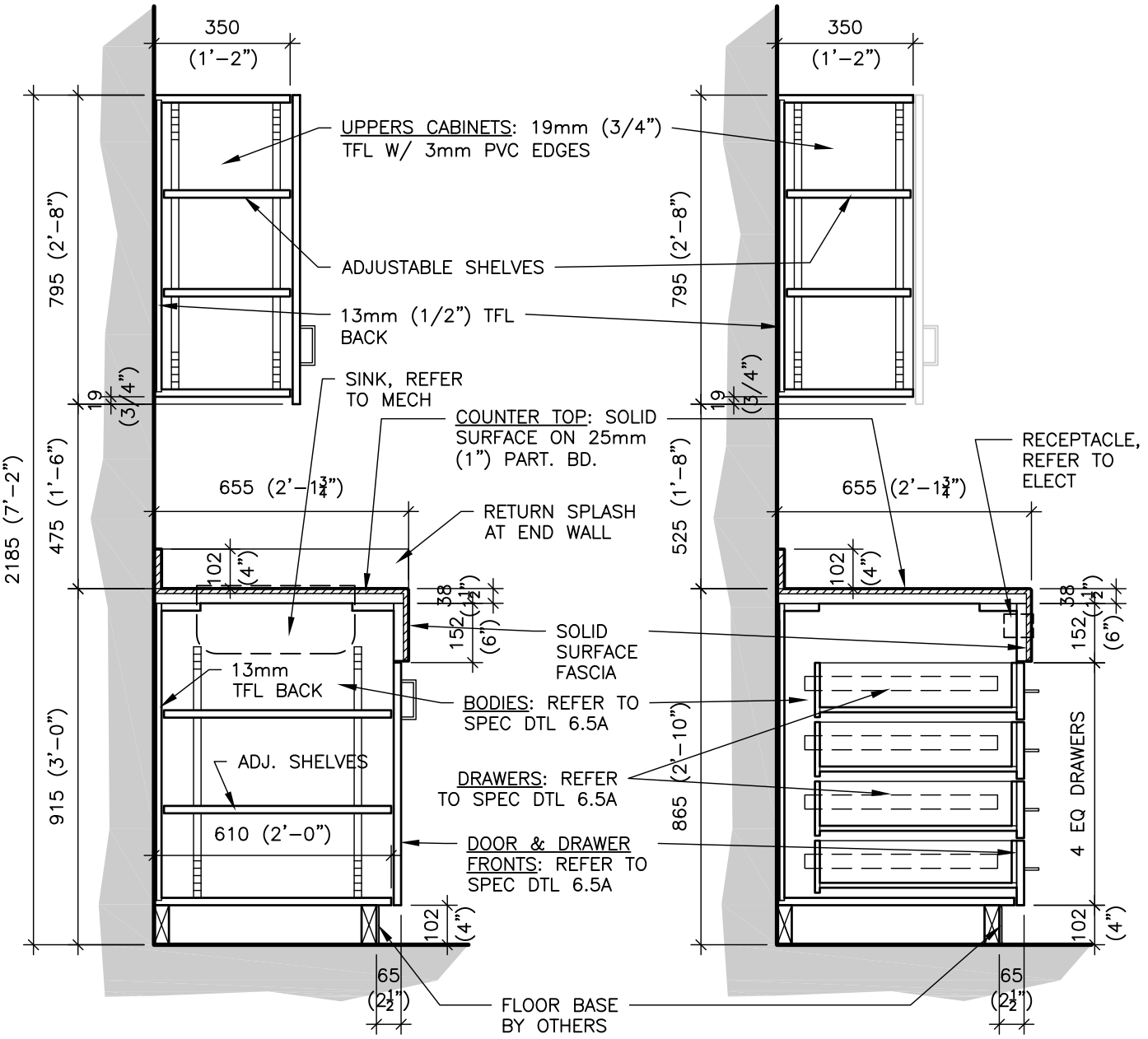
AS-1



SECTION '2A'

Scale: 1:16

SECTION '2B'

Scale: 1:16

REFER TO SPEC DETAIL 6.5A AND SPEC SECTION 06 41 00 FOR ADDITIONAL INFORMATION ON MILLWORK CONSTRUCTION, FINISHES & HARDWARE.

APR 2024

CONSERVATION MILLWORK CABINETS & UPPERS

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AS-2

141 st. anne's road, winnipeg, manitoba, R2M 2Z3

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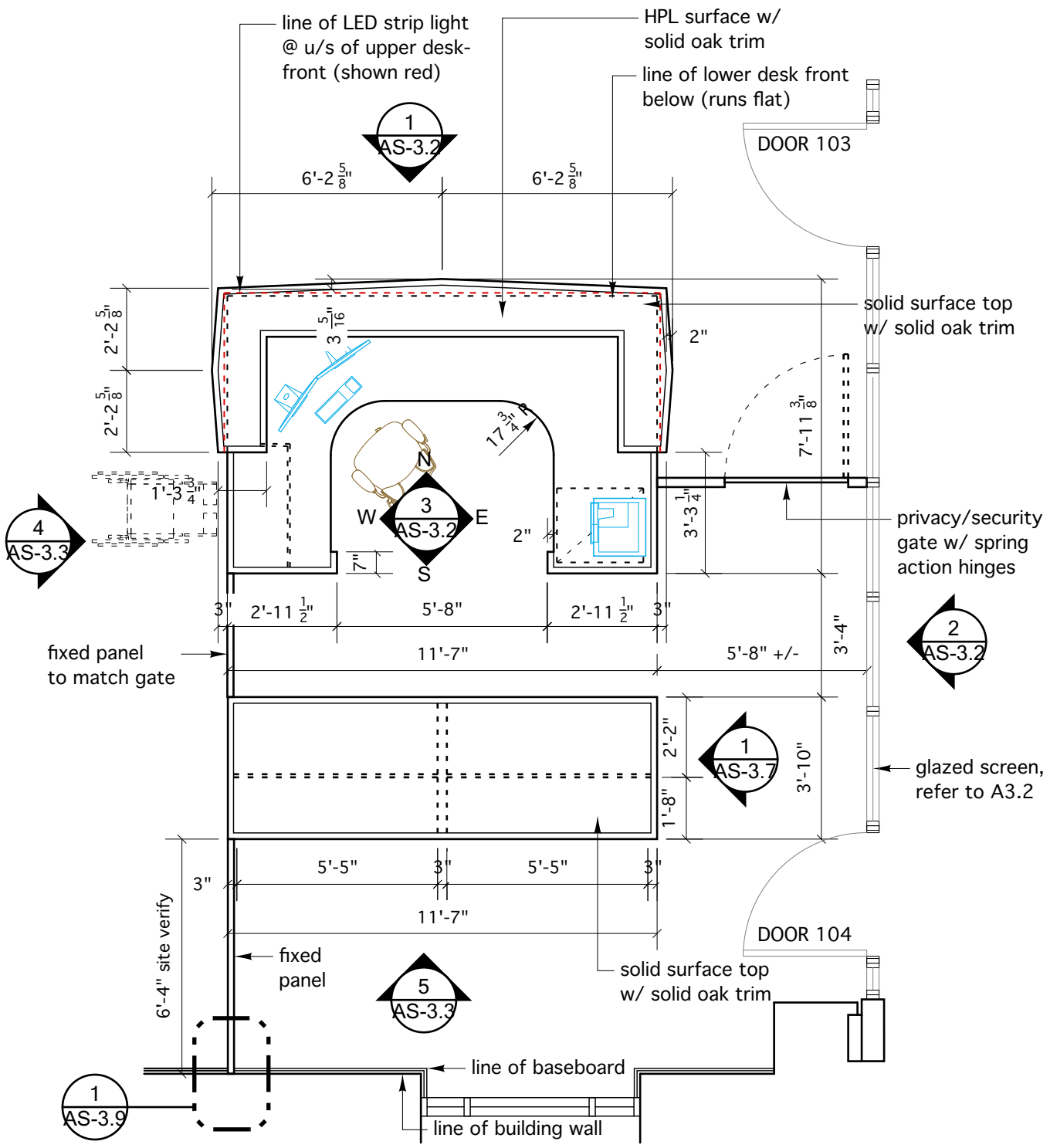

DESK + CONSOLE Enlarged Plan

SCALE: 1/4" = 1'-0"

105 RECEPTION

N

2025 JAN

CITY OF WINNIPEG ARCHIVES REDEVELOPMENT

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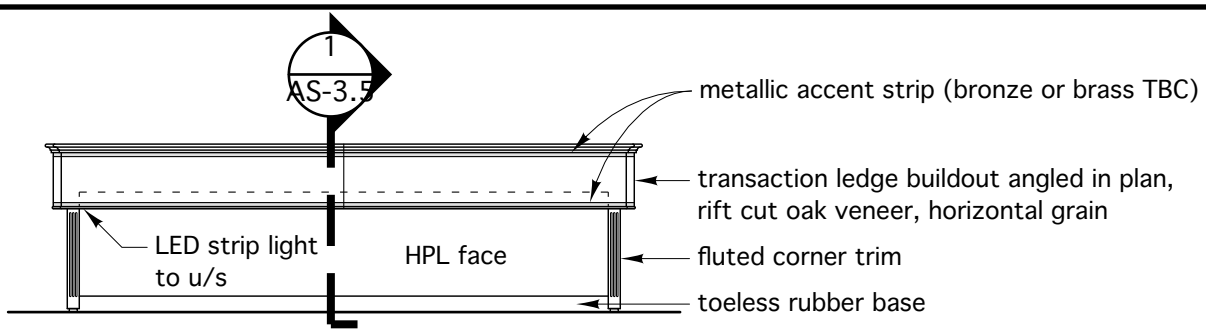
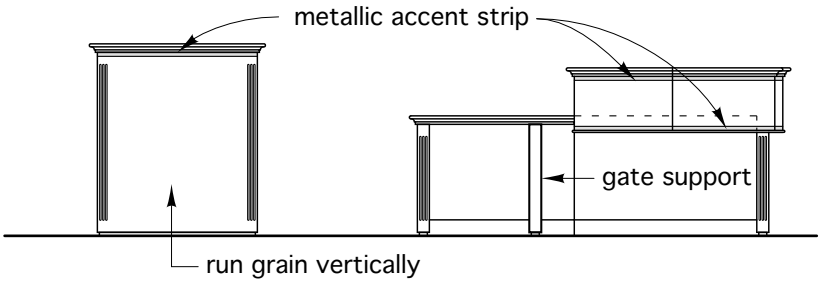
AS-3.1



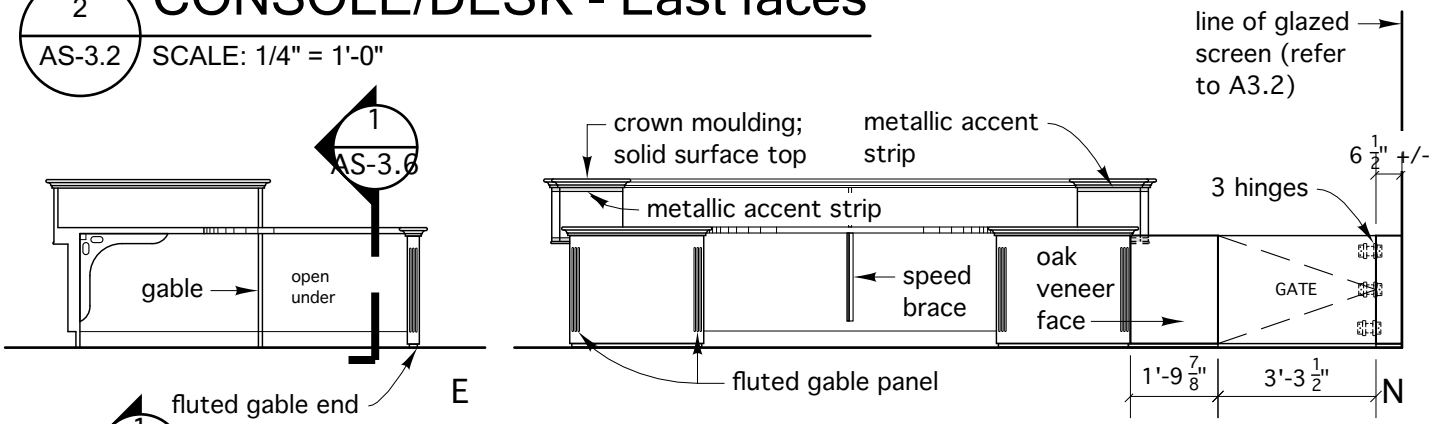
1 DESK - North face

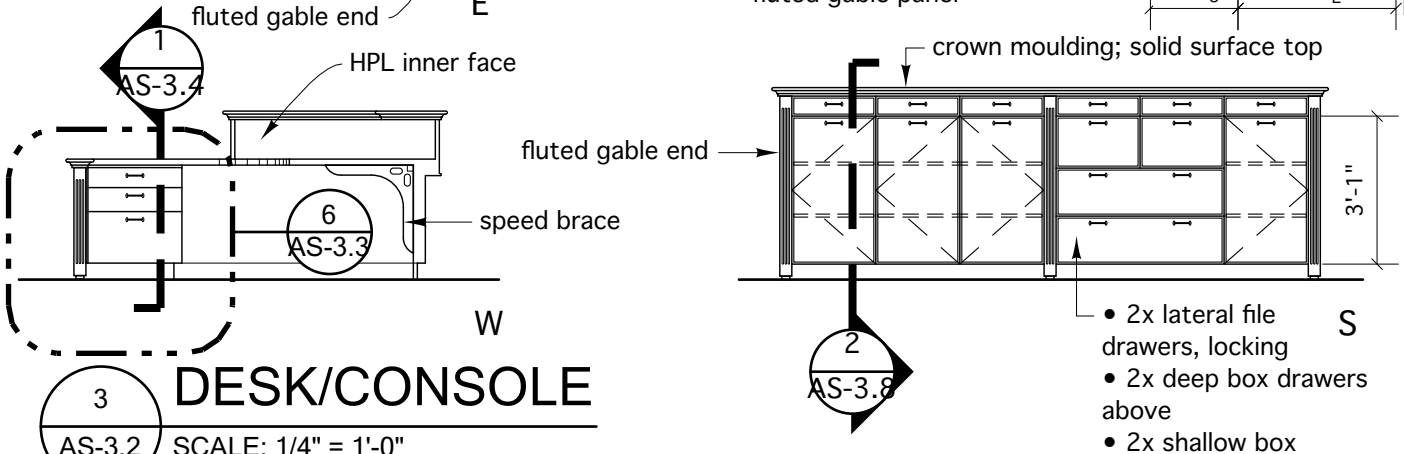
1 / AS-3.2 SCALE: 1/4" = 1'-0"



2 CONSOLE/DESK - East faces

2 / AS-3.2 SCALE: 1/4" = 1'-0"





3 DESK/CONSOLE

3 / AS-3.2 SCALE: 1/4" = 1'-0"

105 RECEPTION

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CITY OF WINNIPEG ARCHIVES REDEVELOPMENT

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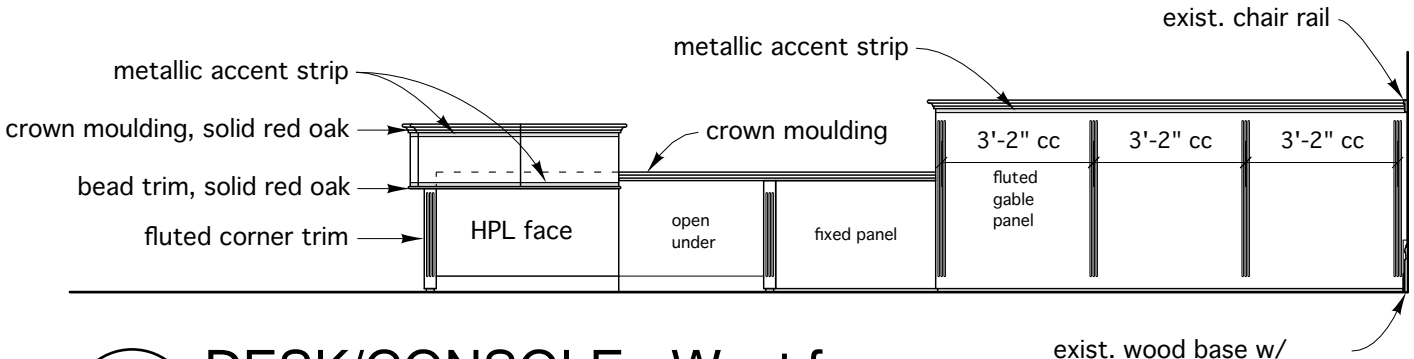
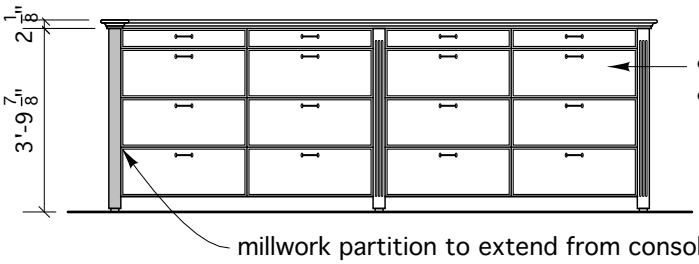


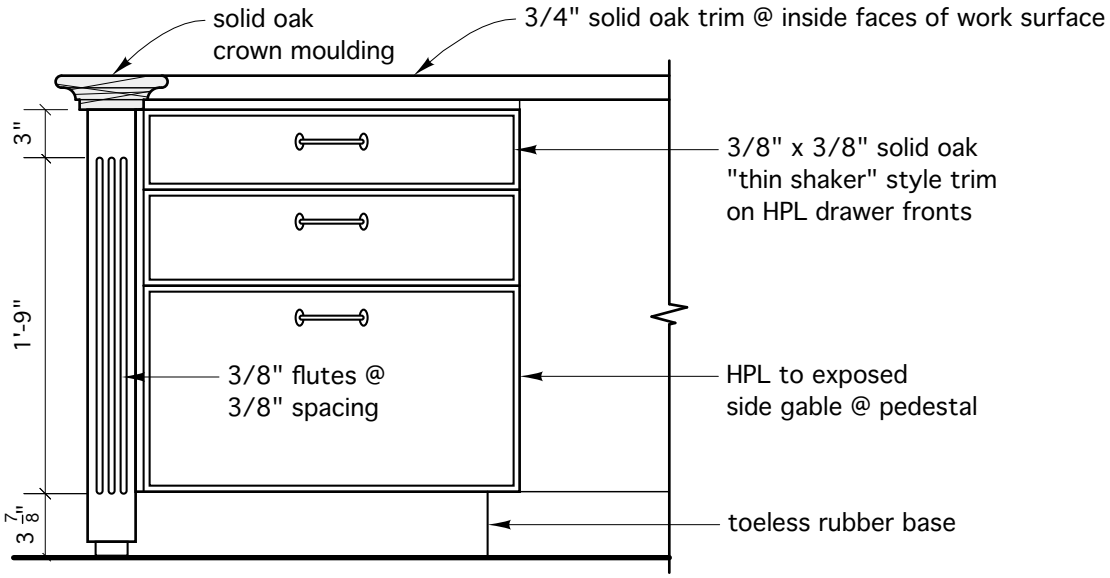
4 AS-3.3 DESK/CONSOLE - West faces

SCALE: 1/4" = 1'-0"



5 AS-3.3 CONSOLE - South face

SCALE: 1/4" = 1'-0"



6 AS-3.3 DESK - Pedestal Enlarged Elevation

SCALE: 1" = 1'-0"

105 RECEPTION

2025 JAN

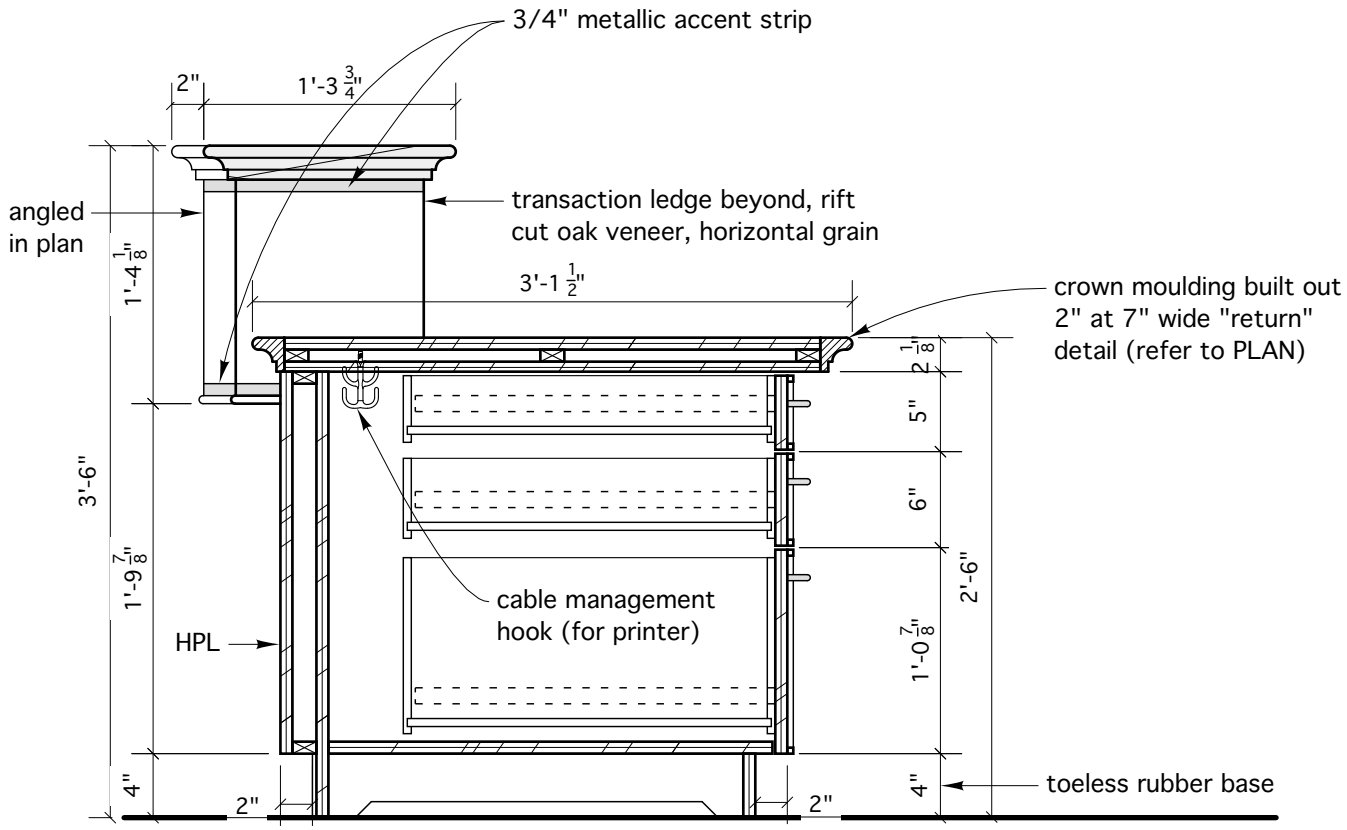
CABINET PULLS: Häfele Canada, Häfele Design model H1970, bronzed and brushed, Art. no. 106.69.000, zinc alloy

170mm total length, 128mm and 160mm cc, 16mm width, 25mm projection

REFER to Spec. Details 6.5 series for additional information.
NOTE: revised to City of Winnipeg WADS (confirm).

Provide cable grommet c/w cap: 3 at U-shaped desk (locations to be confirmed during shop drawing review). Allow for 2 at top of Console, requirement to be confirmed during pricing.

GATE: Richelieu model 810FBB, Onward Double Action Spring Hinge for Interior Door, 3 3/4", colour Black, 2 pack. Provide 3 per gate, inside mount. Or approved as Equal.



1 / AS-3.4

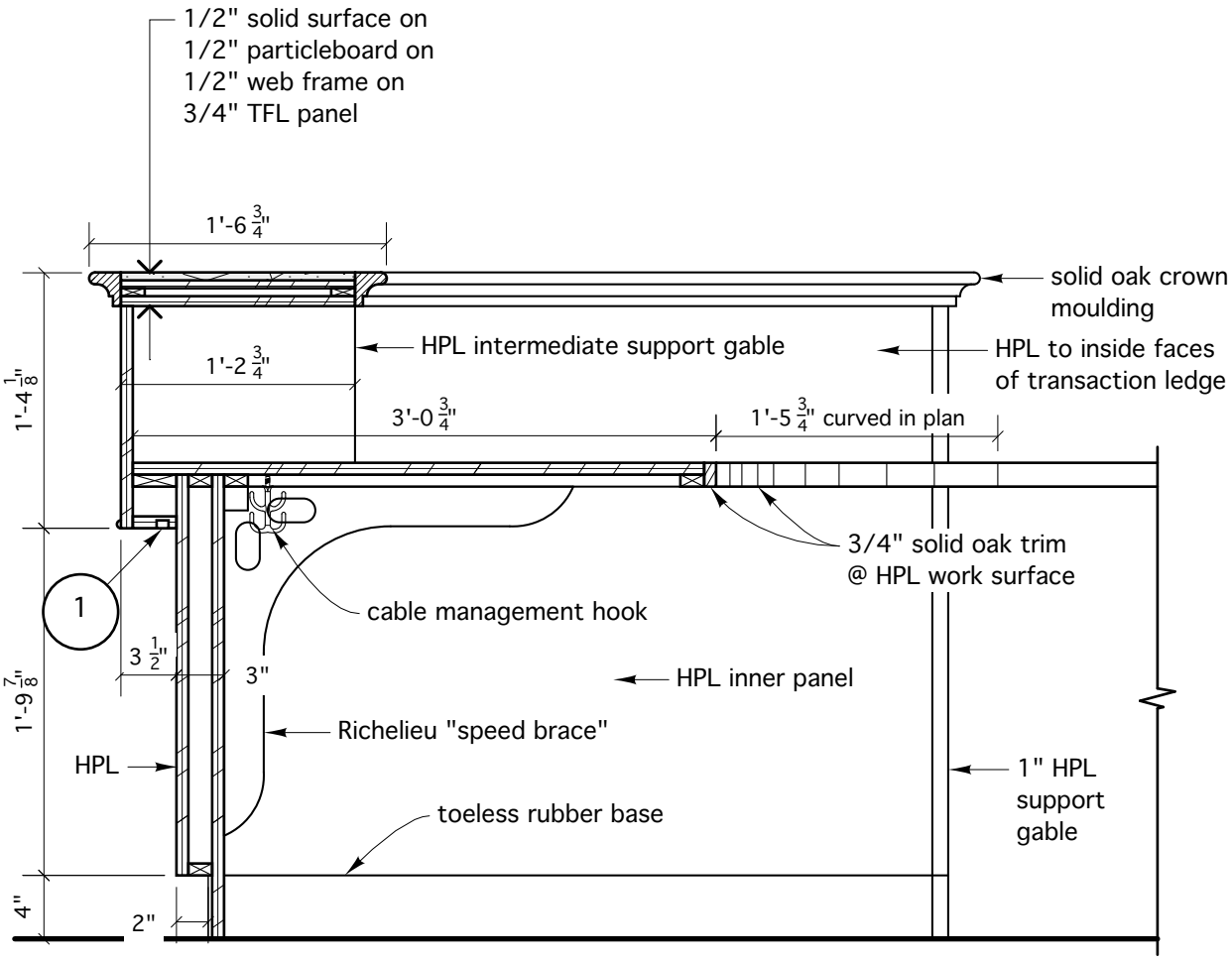
SECTION DETAIL @ Drawer Pedestal

SCALE: 1" = 1'-0"

105 RECEPTION

2025 JAN

1 LED light strip recessed into underside of upper desk front (all sides). Refer to Electrical.

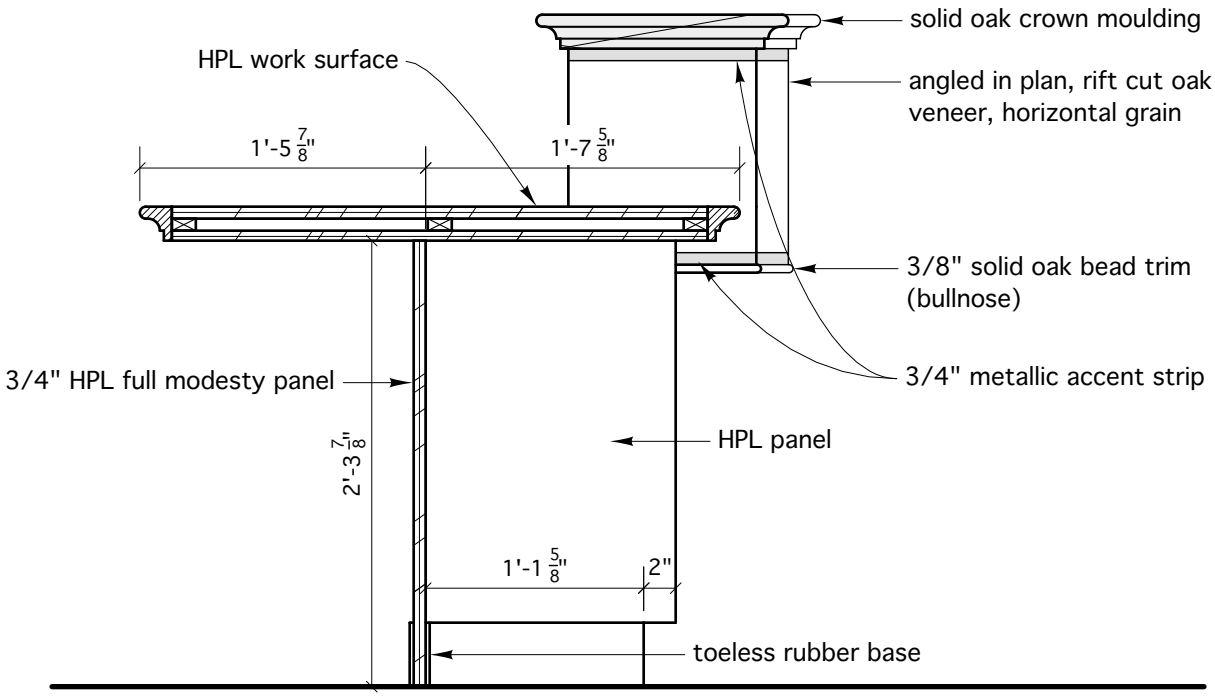


1 / AS-3.5 SECTION DETAIL @ Desk Front

SCALE: 1" = 1'-0"

105 RECEPTION

2025 JAN



1 / AS-3.6

SECTION DETAIL @ Sit-down Area

SCALE: 1" = 1'-0"

105 RECEPTION

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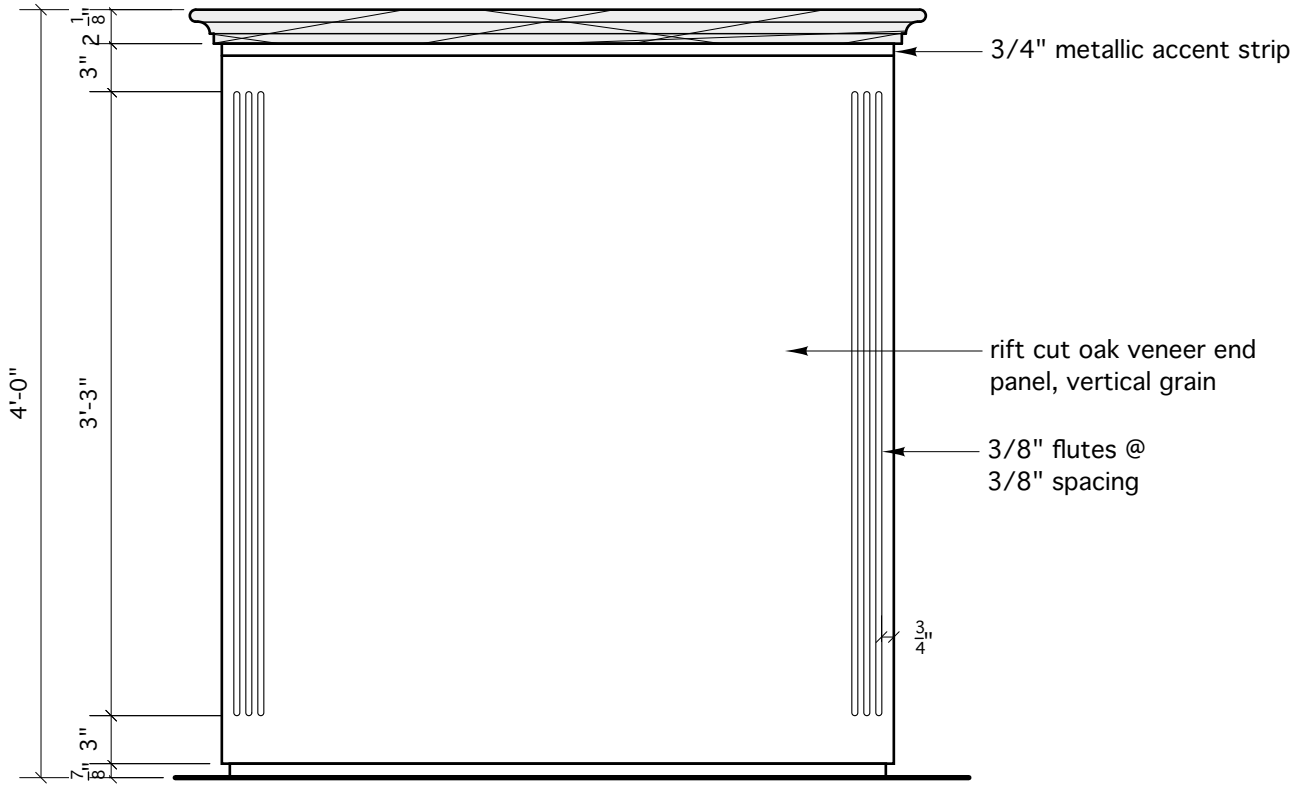
AS-3.6



1 / AS-3.7 Console End Enlarged Elevation

SCALE: 1" = 1'-0"

105 RECEPTION

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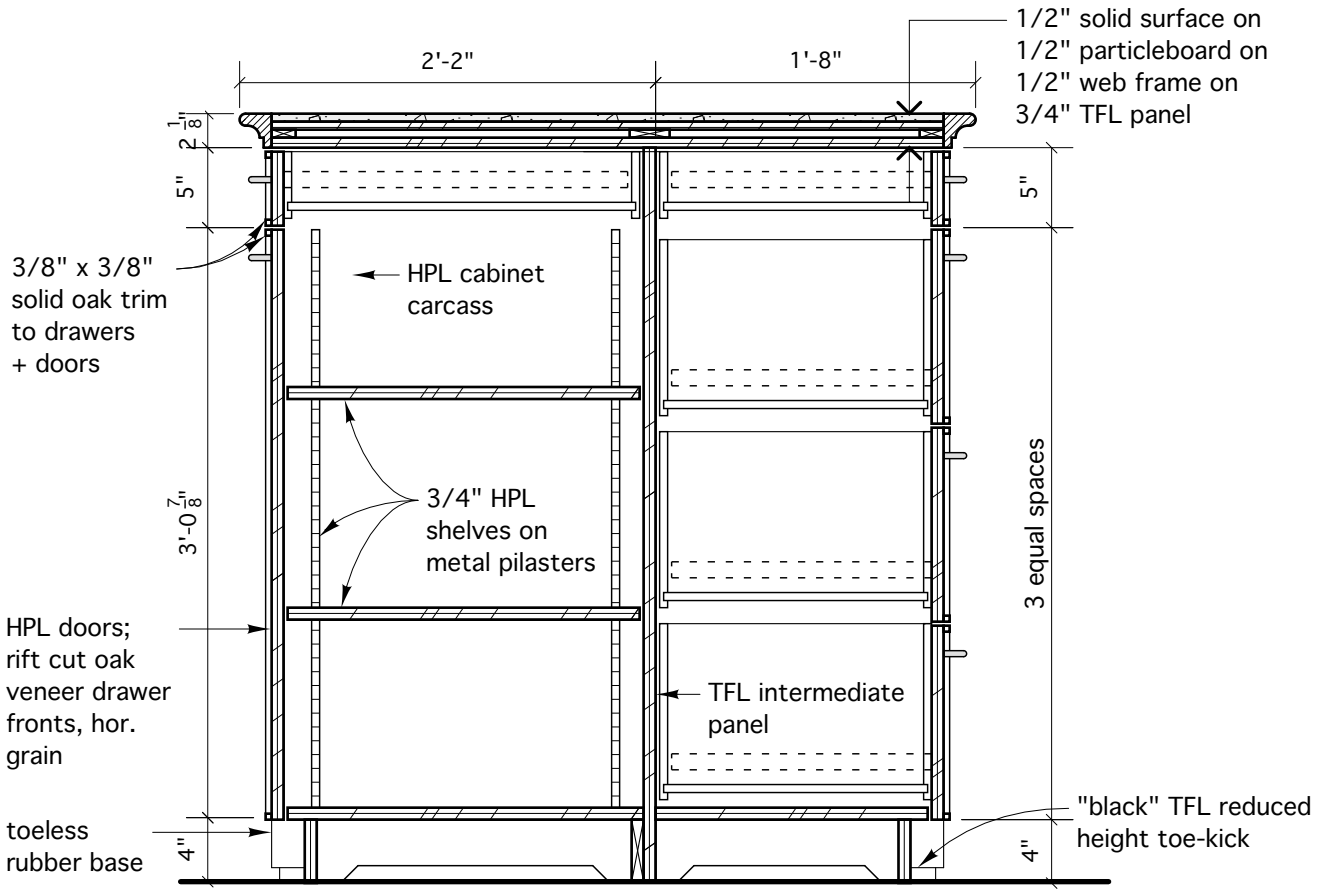
AS-3.7

NOTE: at rear of CONSOLE, provide FA bars for conventional lateral file storage (side to side, full width) AND removable dividers + short FA bars to allow for "vertical" filing, i.e.: back to front • all 12 file drawers • for LEGAL-size folders



2 / AS-3.8 SECTION DETAIL @ Console

SCALE: 1" = 1'-0"

105 RECEPTION

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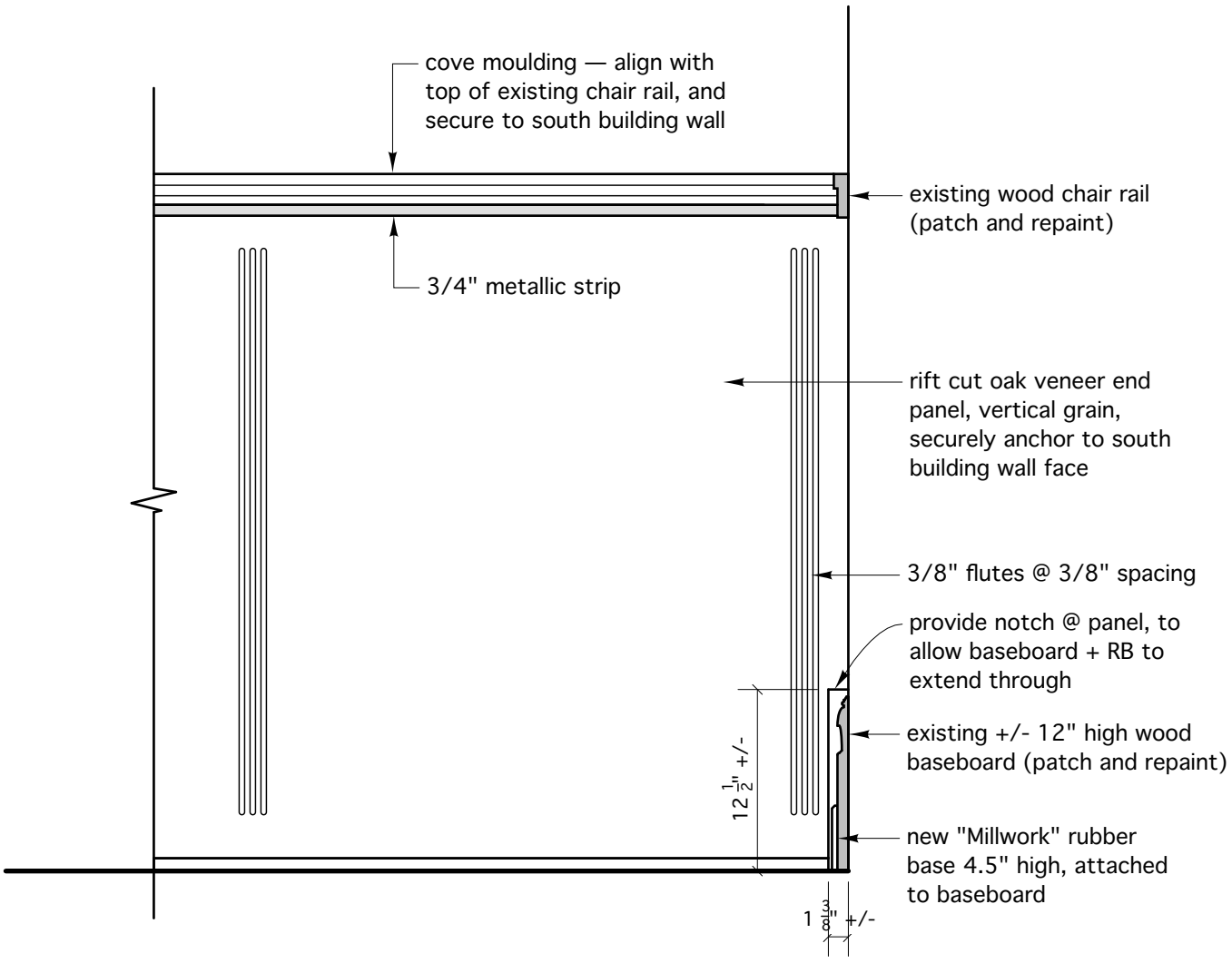
AS-3.8

NOTE: site verify height and thickness of wood baseboard, and height and thickness of wood chair rail. Design intent is for top of new cove moulding to align with top of chair rail. Adjust overall height of console to suit, if required.



105 RECEPTION

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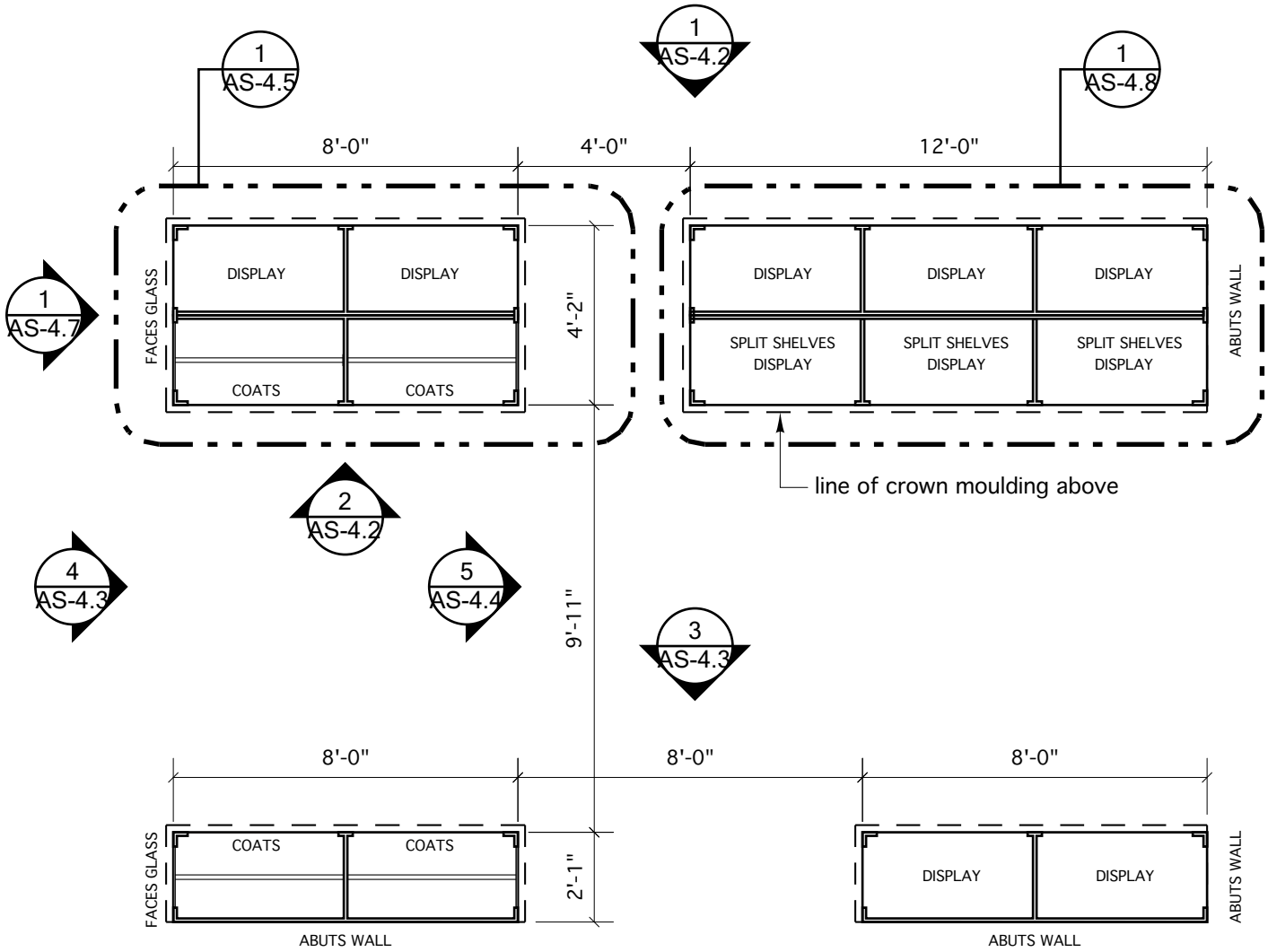
AS-3.9



ENLARGED PLAN

SCALE: 1/4" = 1'-0"

N

104 CLOAK ROOM

2025 JAN

CITY OF WINNIPEG ARCHIVES REDEVELOPMENT

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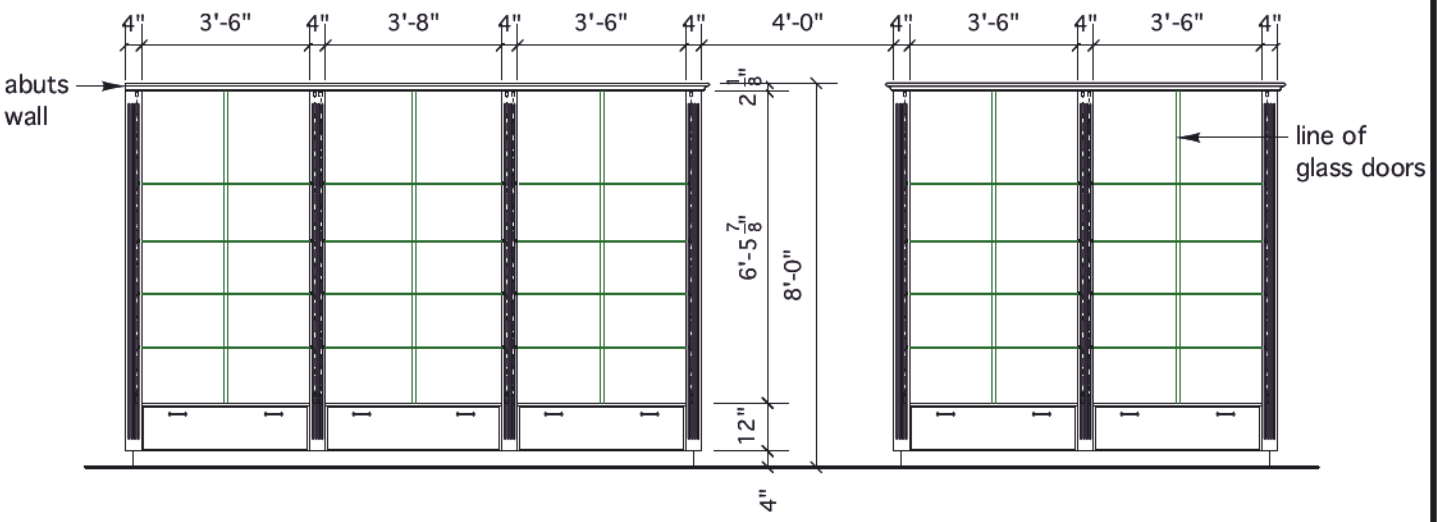
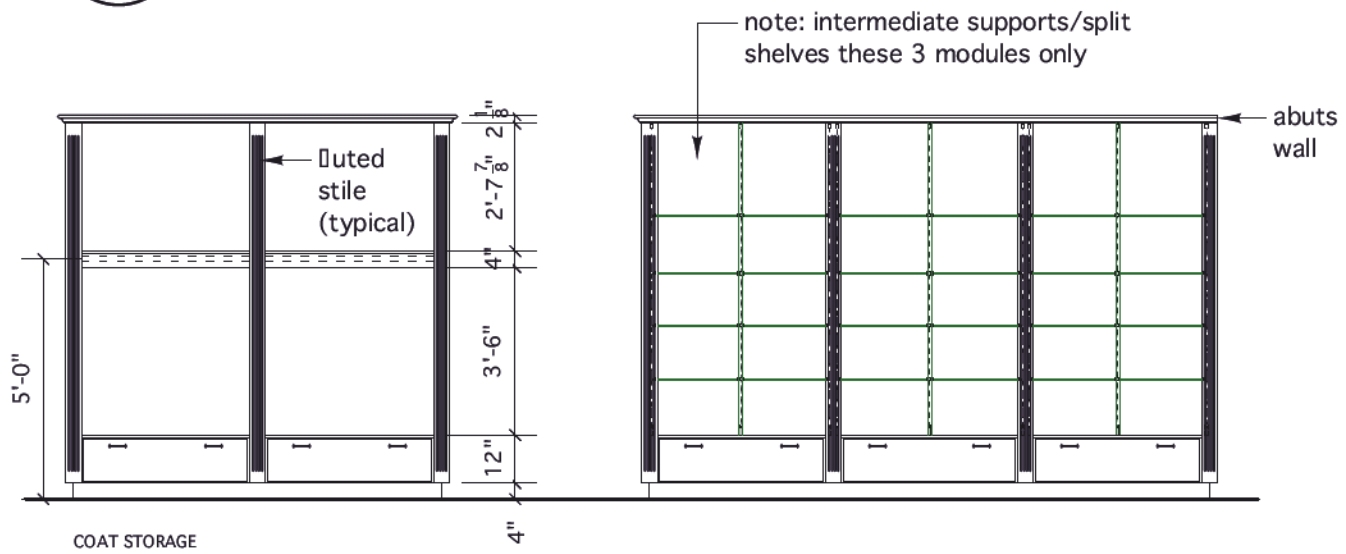
AS-4.1

NOTE: where cabinets abut walls, delete crown moulding to allow cabinet to sit flush.



1 / AS-4.2 **DISPLAY - Upper North faces**

SCALE: 1/4" = 1'-0"



2 / AS-4.2 **COATS/DISPLAY - Upper South faces**

SCALE: 1/4" = 1'-0"

104 CLOAK ROOM

2025 JAN

CITY OF WINNIPEG ARCHIVES REDEVELOPMENT

2624

mcm architects inc.

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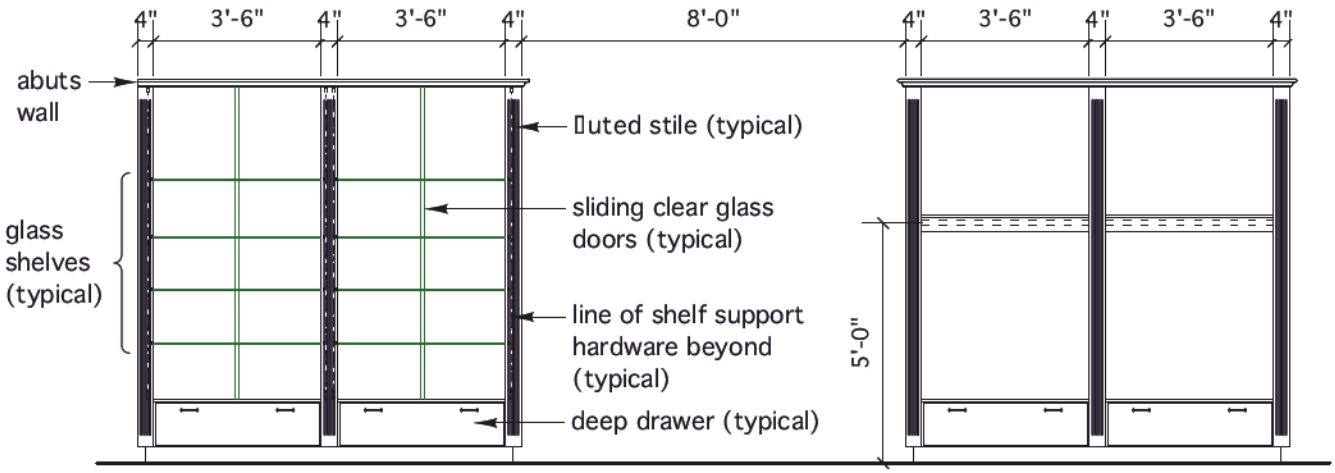
260-8th street, brandon, manitoba, R7A 3X3

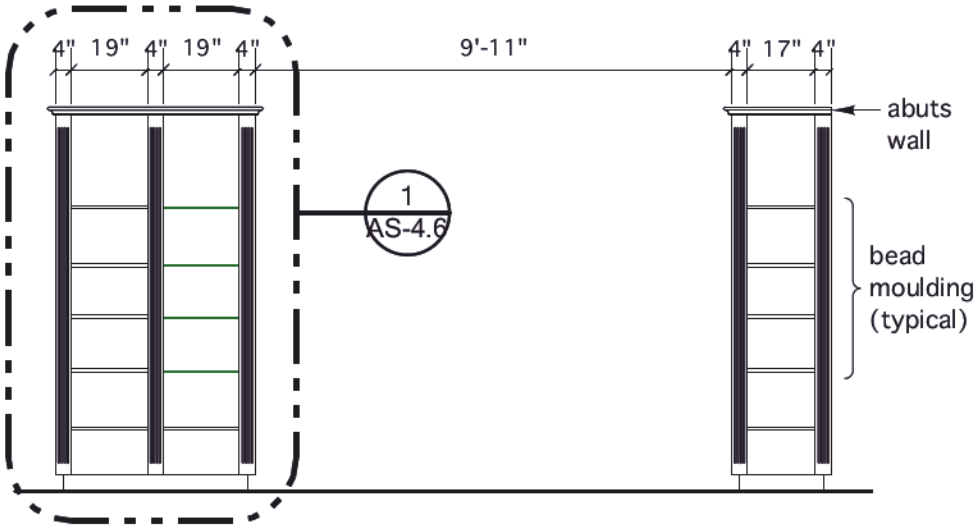
AS-4.2

NOTE: where cabinets abut walls, delete crown moulding to allow cabinet to sit flush.



3 / AS-4.3 DISPLAY/COATS - Lower North faces

SCALE: 1/4" = 1'-0"



4 / AS-4.3 DISPLAY/COATS/COATS - West faces @ glass

SCALE: 1/4" = 1'-0"

104 CLOAK ROOM

2025 JAN

CITY OF WINNIPEG ARCHIVES REDEVELOPMENT

2624

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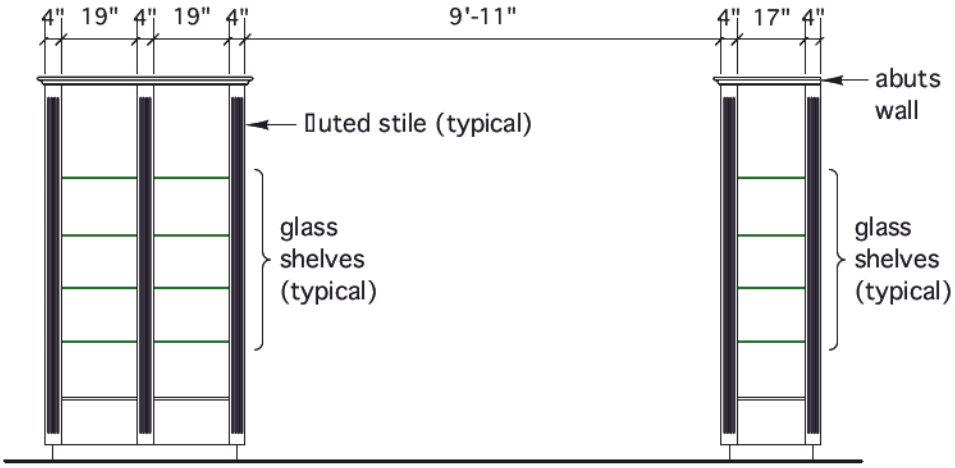
AS-4.3

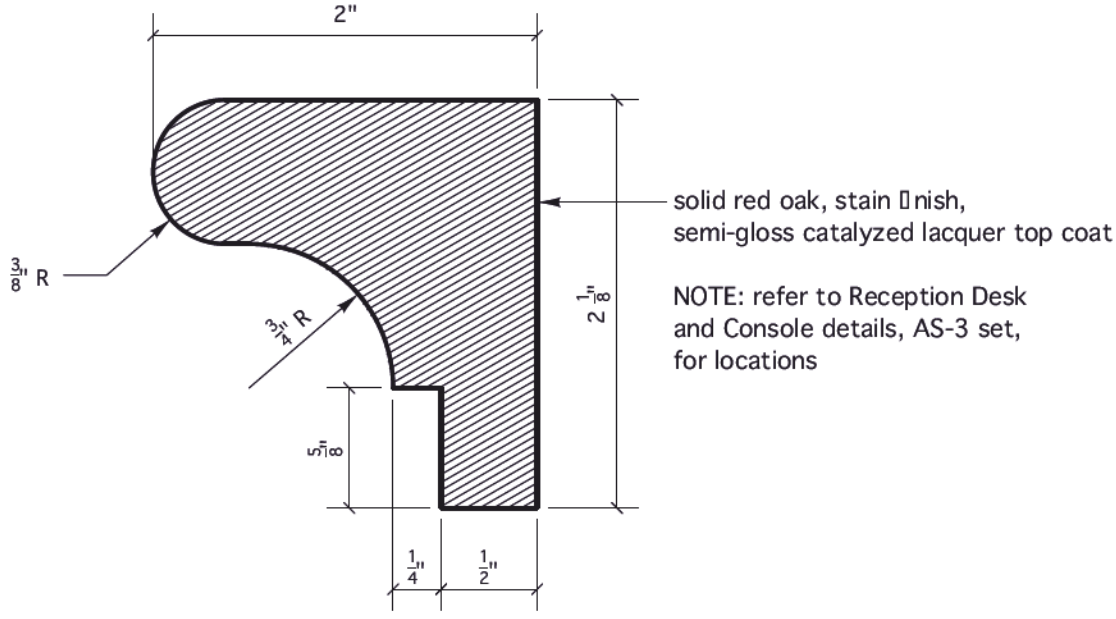
NOTE: where cabinets abut walls, delete crown moulding to allow cabinet to sit □ush.



5 / AS-4.4

DISPLAY/DISPLAY - West faces @ aisle

SCALE: 1/4" = 1'-0"



2 / AS-4.4

CROWN MOULDING DETAIL

SCALE: 1:1

104 CLOAK ROOM

2025 JAN

CITY OF WINNIPEG ARCHIVES REDEVELOPMENT

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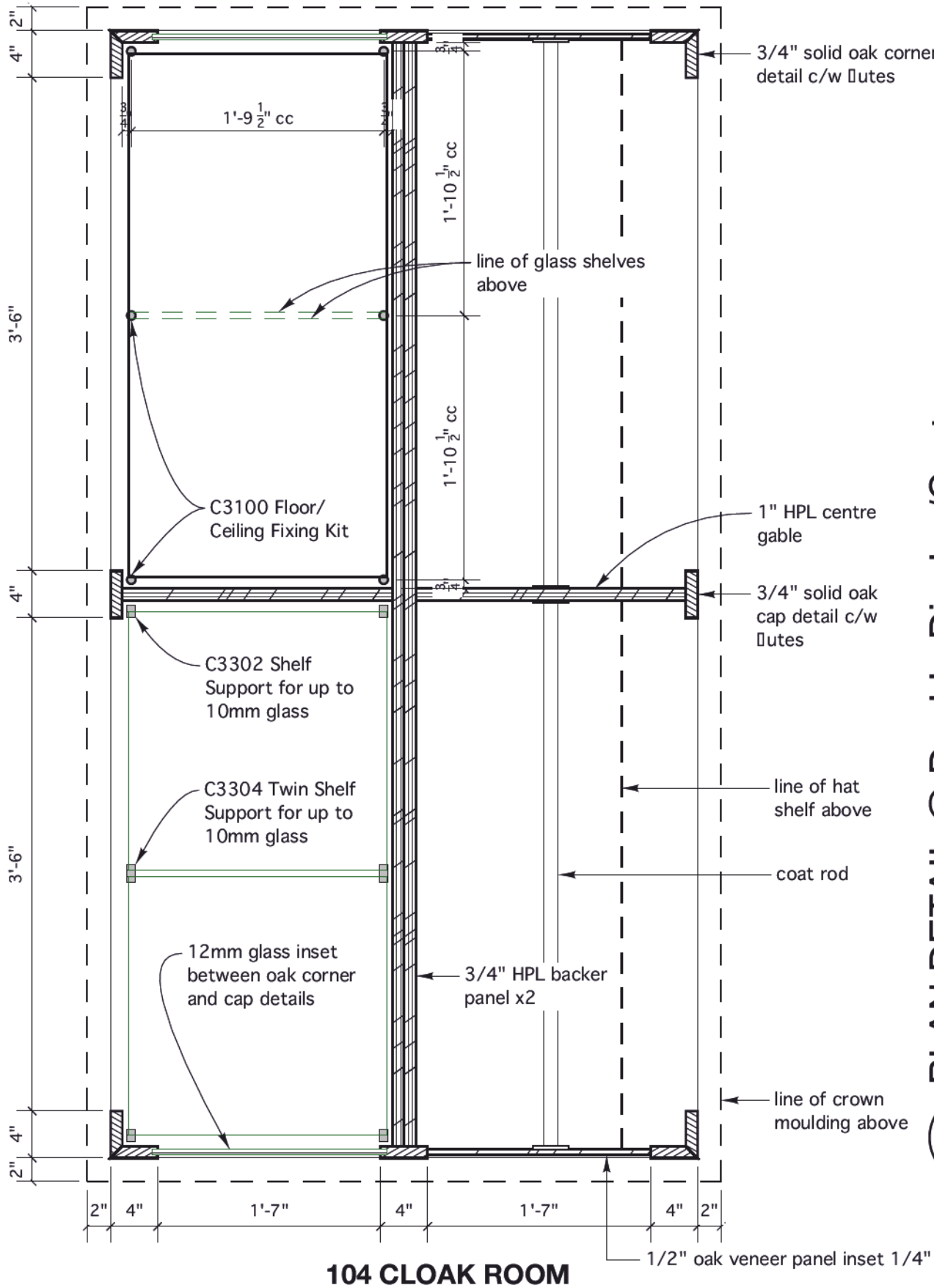
AS-4.4



104 CLOAK ROOM

1 PLAN DETAIL @ Double Display/Coats

SCALE: 1" = 1'-0"

1 / AS-4.5

2025 JAN

CITY OF WINNIPEG ARCHIVES REDEVELOPMENT

2624

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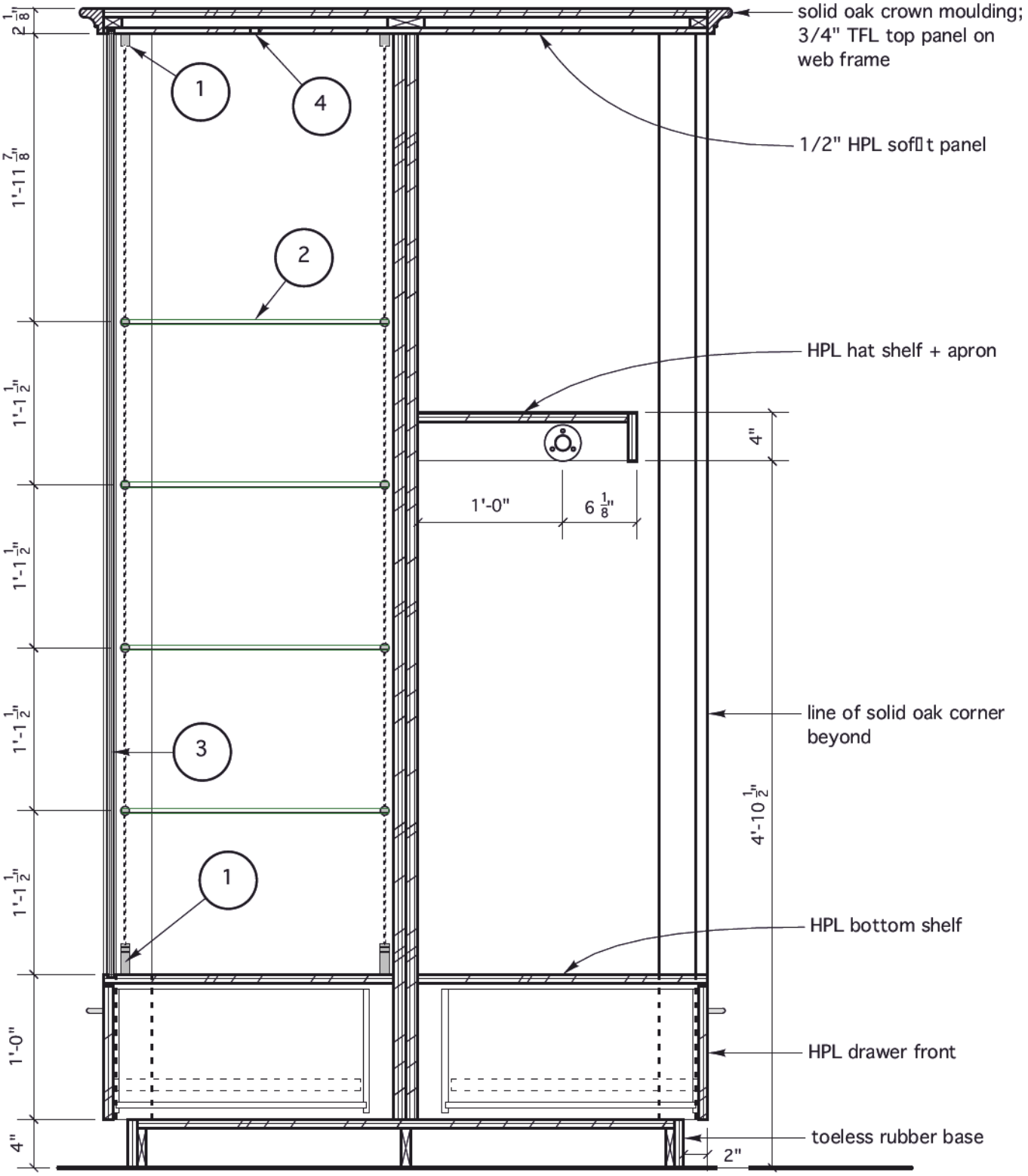
AS-4.5



1 / AS-4.6 SECTION DETAIL @ Double Display/Coats

SCALE: 1" = 1'-0"

104 CLOAK ROOM

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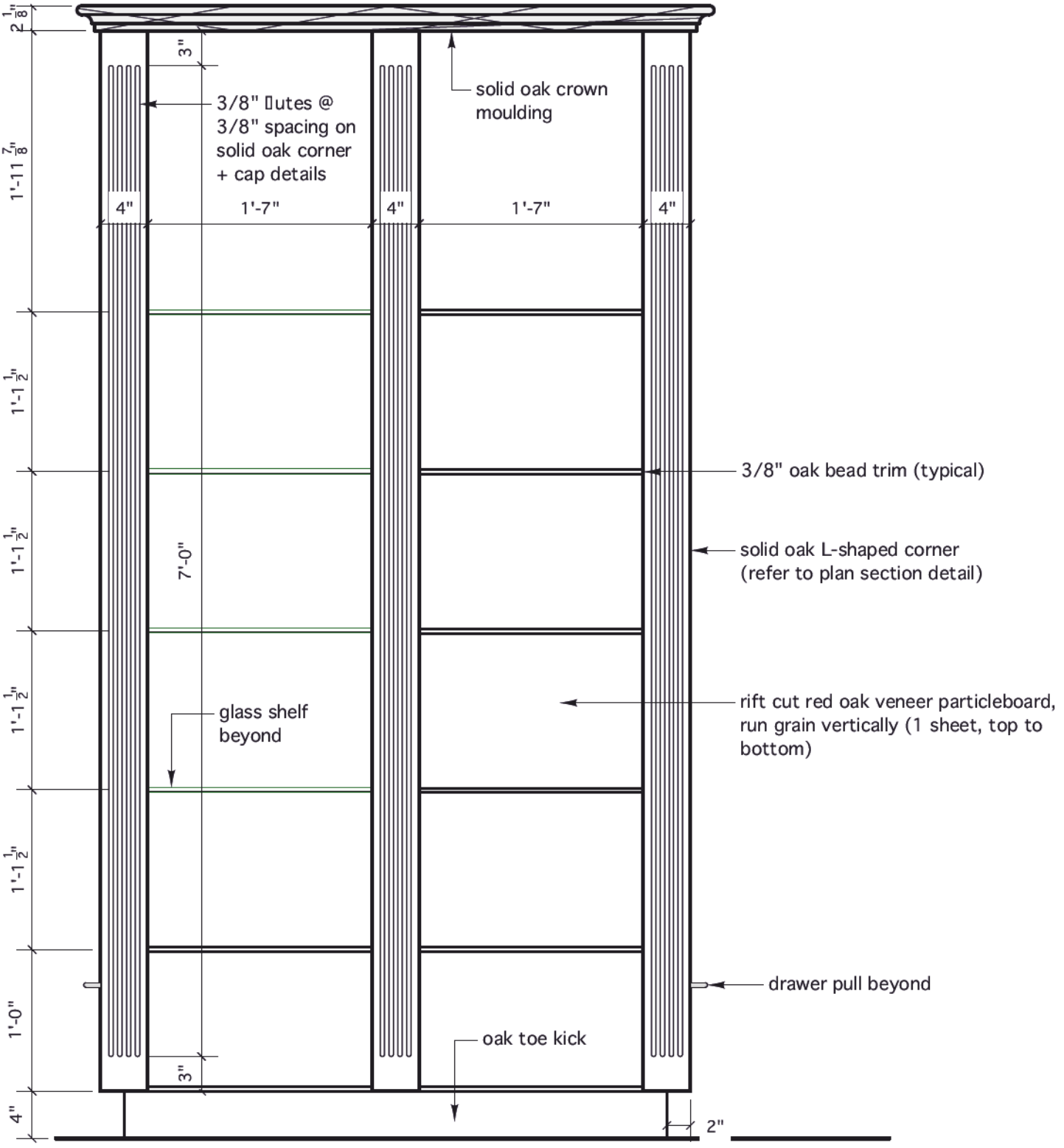
AS-4.6



1 / AS-4.7

Enlarged END Elevation @ Double Display/Coats

SCALE: 1" = 1'-0"

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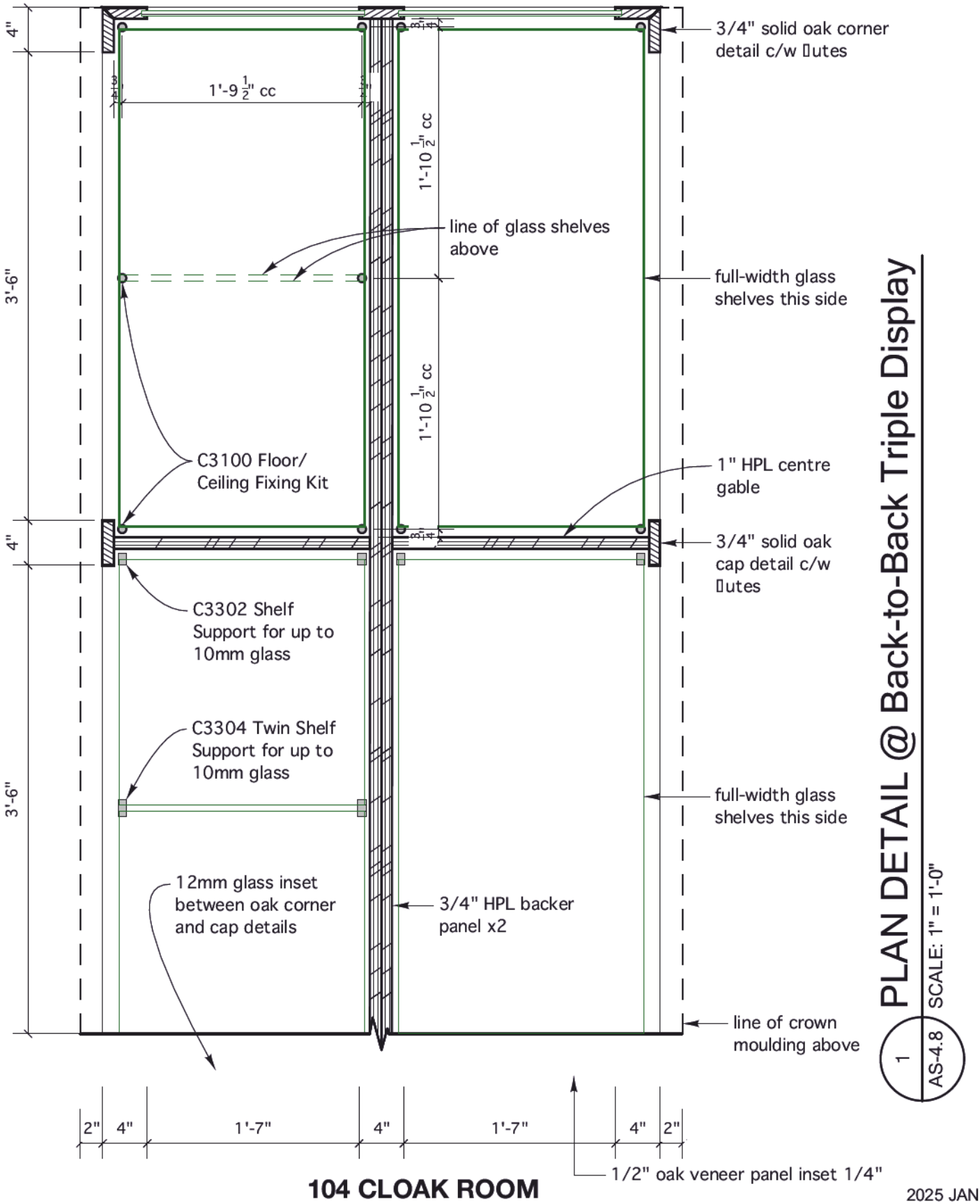
AS-4.7



PLAN DETAIL @ Back-to-Back Triple Display

1 AS-4.8 SCALE: 1" = 1'-0"

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AS-4.8

HARDWARE AND LIGHTING NOTES

Shelf support hardware as manufactured by MUSTANG SYSTEMS INC., and distributed by WESTWIND DESIGN & DISPLAY SPECIALTY LTD., 1201-42 Avenue S.E., Calgary, AB T2G 1Z5, TEL 403.243.4741, FAX 403.243.4957, e: admin@westwinddezign.com, www.westwinddezign.com

3mm cable rupture is rated at 300 kilograms. Fabricator shall verify maximum recommended spacing and glass thicknesses/shelf supports based on anticipated load factor prior to ordering.

Or approved "as Equal".

1

C3100 Floor/Ceiling Fixing Kit (4 meters)*
- 18.5 mm top xing
- 4 m stainless steel cable 3 mm
- oor anchor with adjusting sleeve
- Allen key and xing screws supplied

2

10mm polished plate glass shelf c/w C3302 Shelf Support For Up To 10 mm and C3304 Twin Shelf Support For Up To 10 mm

3

6mm tempered glass sliding doors c/w locks and hardware as speci ed (3227 ABLOY, Montreal, or KV965 Adjustable Lock)
- 6mm PAR clear glass doors
- Knape & Vogt "Roll Ezy" ball bearing track, 9992 ZC assembly includes:
    - 993 upper channel
    - 995 shoe
    - 997 carrier
    - 999 lower track
    - Note: use extra pieces of 995 shoe as reinforcing to meeting edges of glass

4

Display cabinet lighting, recessed into sof t panel H fele "Loox LED 2029"
- Bar light with linkable cables
- 3000 warm white, nominal voltage 12.0 V
- Housing material: aluminum
- Colour/ nish: pro le, anodized; diffuser, satin nish
- 1067mm (42") long x 13mm (1/2") high x 18.5mm (0.73") wide
- for glue xing, or screw xing with provided retaining clips
- includes Mains Lead, Country-speci c, C7 socket
- includes Adapter, Loox device - Loox5 driver

Or approved "as Equal"

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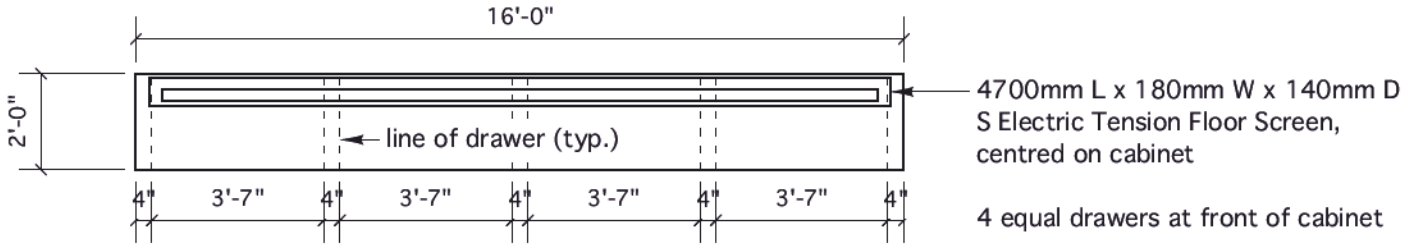
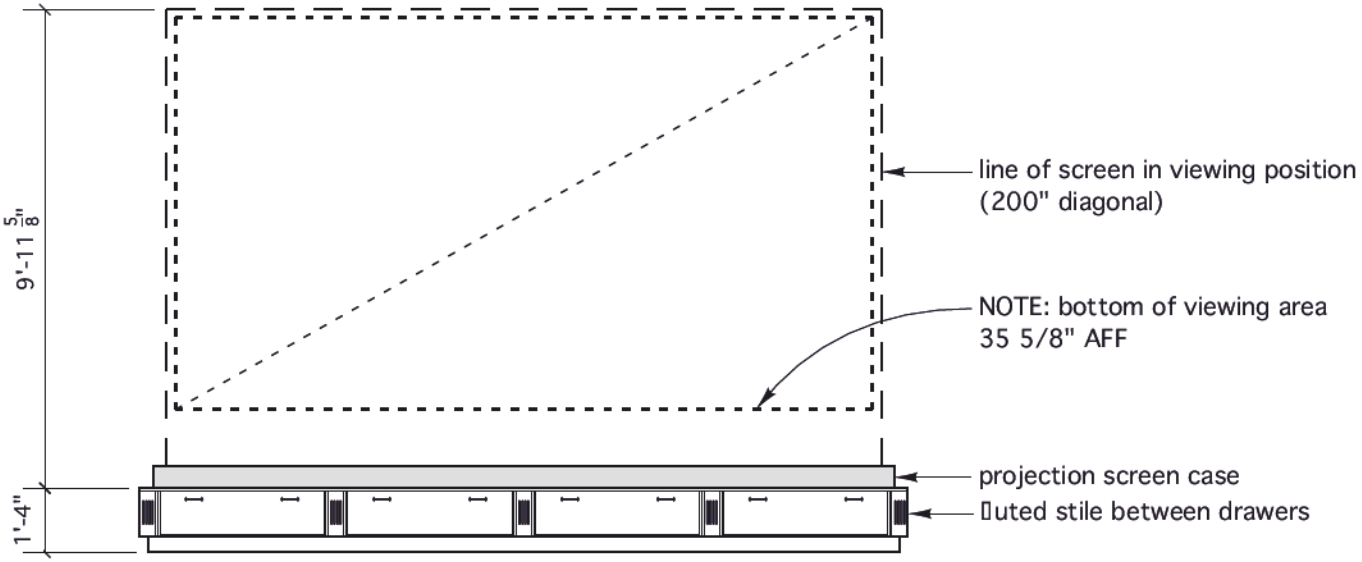
AS-4.9



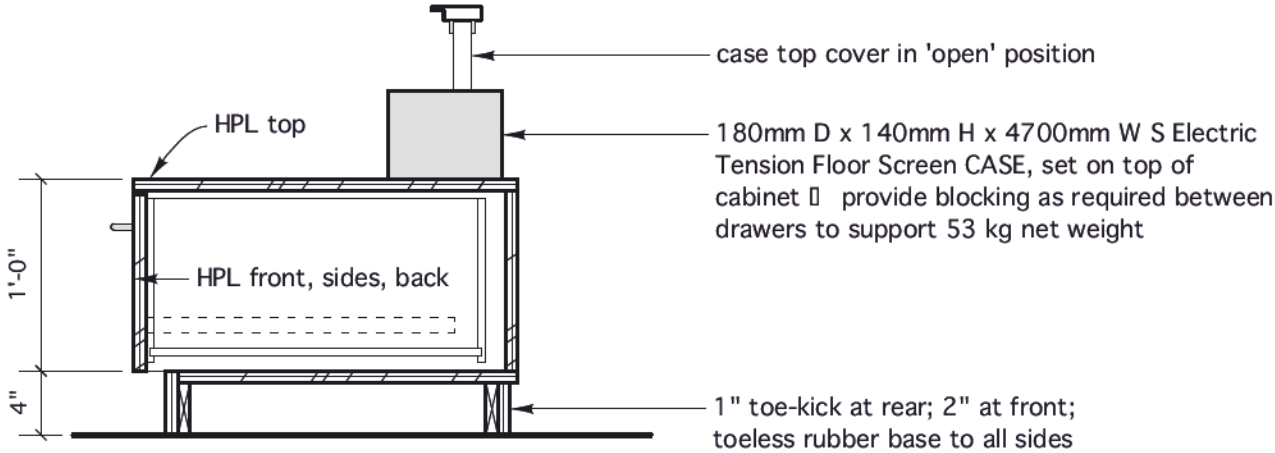
PROJECTION SCREEN CABINET

SCALE: 1/4" = 1'-0"



1 / AS-4.10 ELEVATION

SCALE: 1/4" = 1'-0"



2 / AS-4.10 SECTION DETAIL @ Projector Screen

SCALE: 1" = 1'-0"

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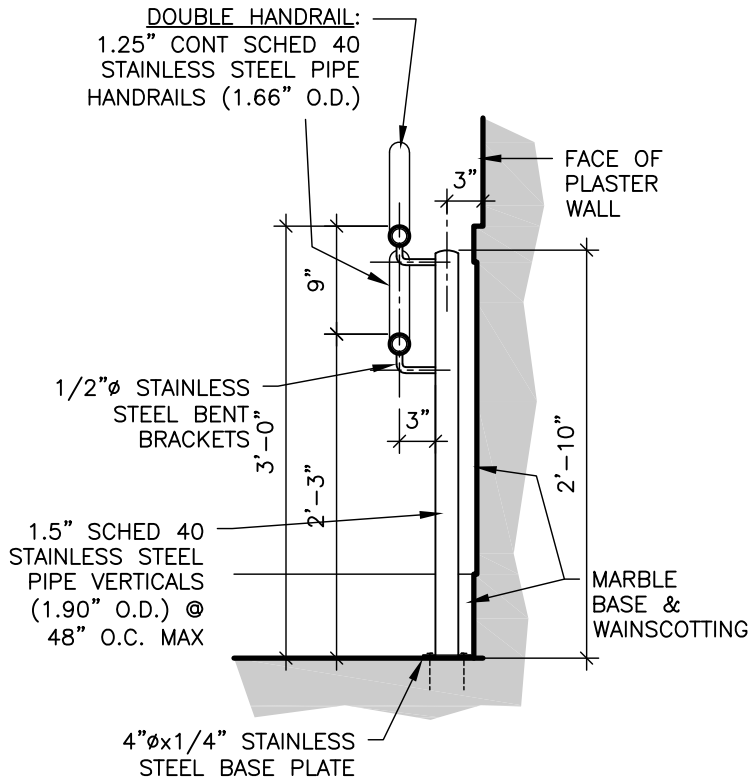
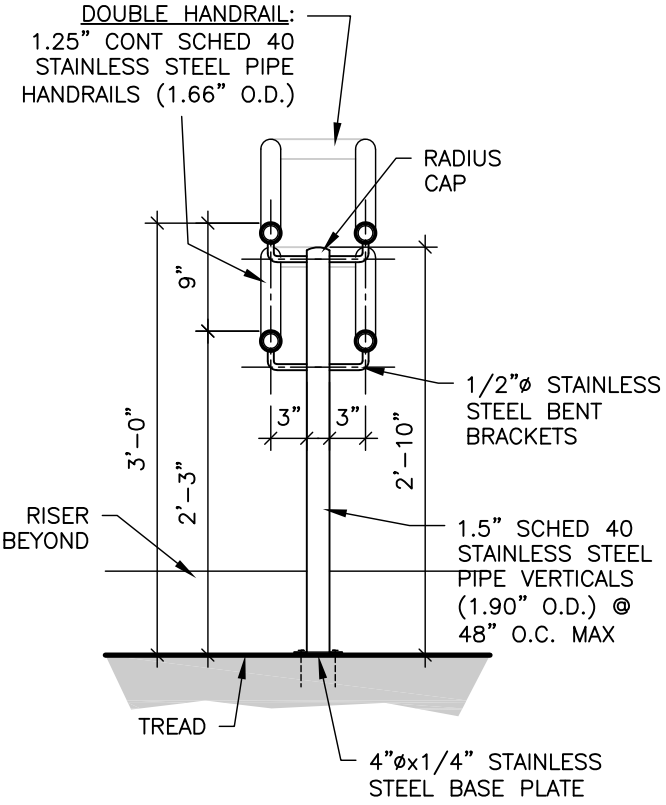
AS-4.10



A OUTER HANDRAIL
3/4" = 1'-0"



B INTERMEDIATE HANDRAIL
3/4" = 1'-0"

STAINLESS STEEL HANDRAIL DETAILS
3/4" = 1'-0"

07 AUG 2024

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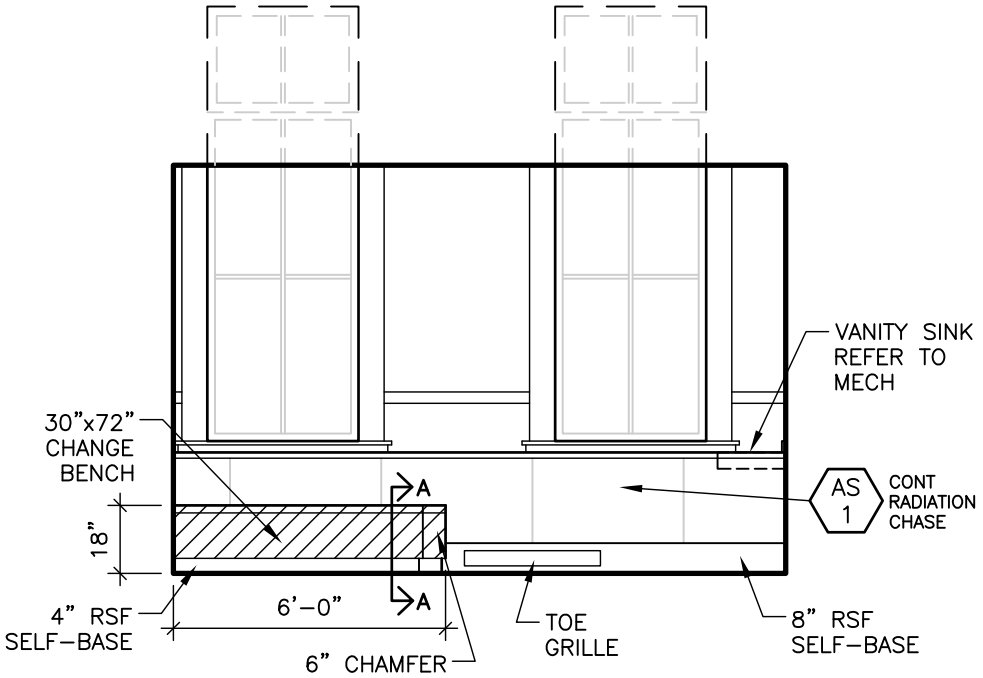
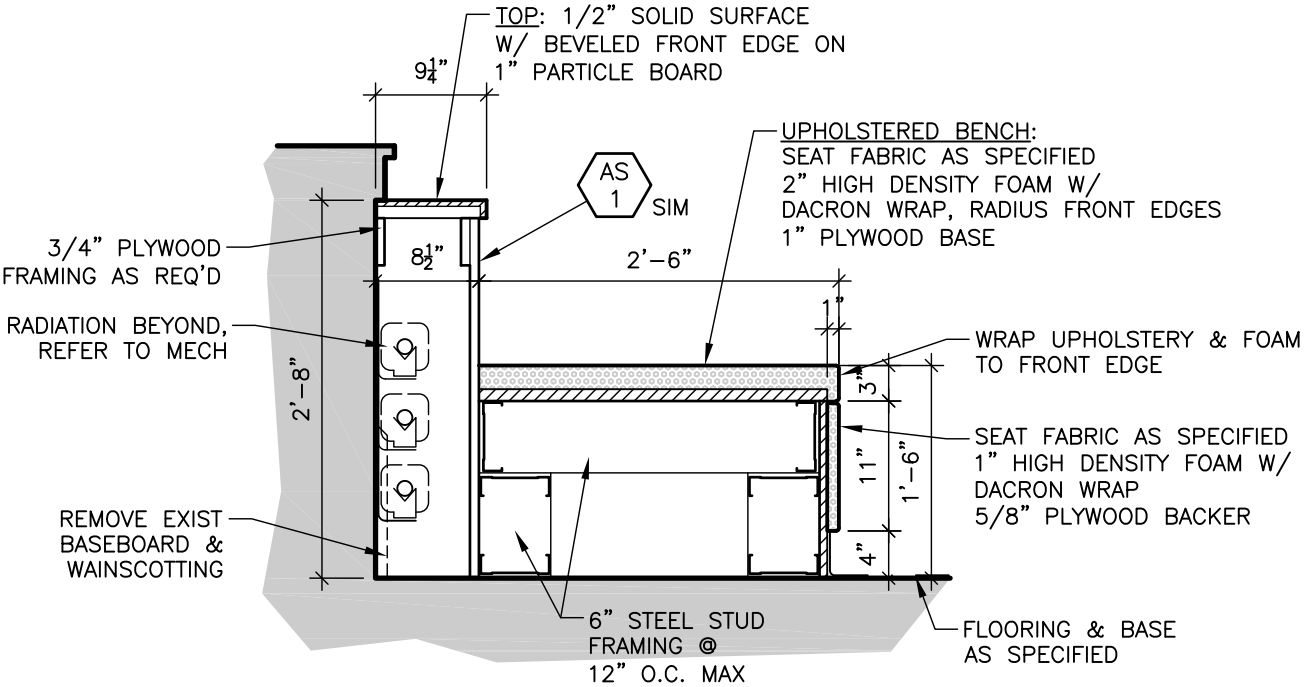
AS-5



FRONT ELEVATION



CHANGE BENCH SECTION 'AA'

1:16

15 AUG 2024

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AS-6

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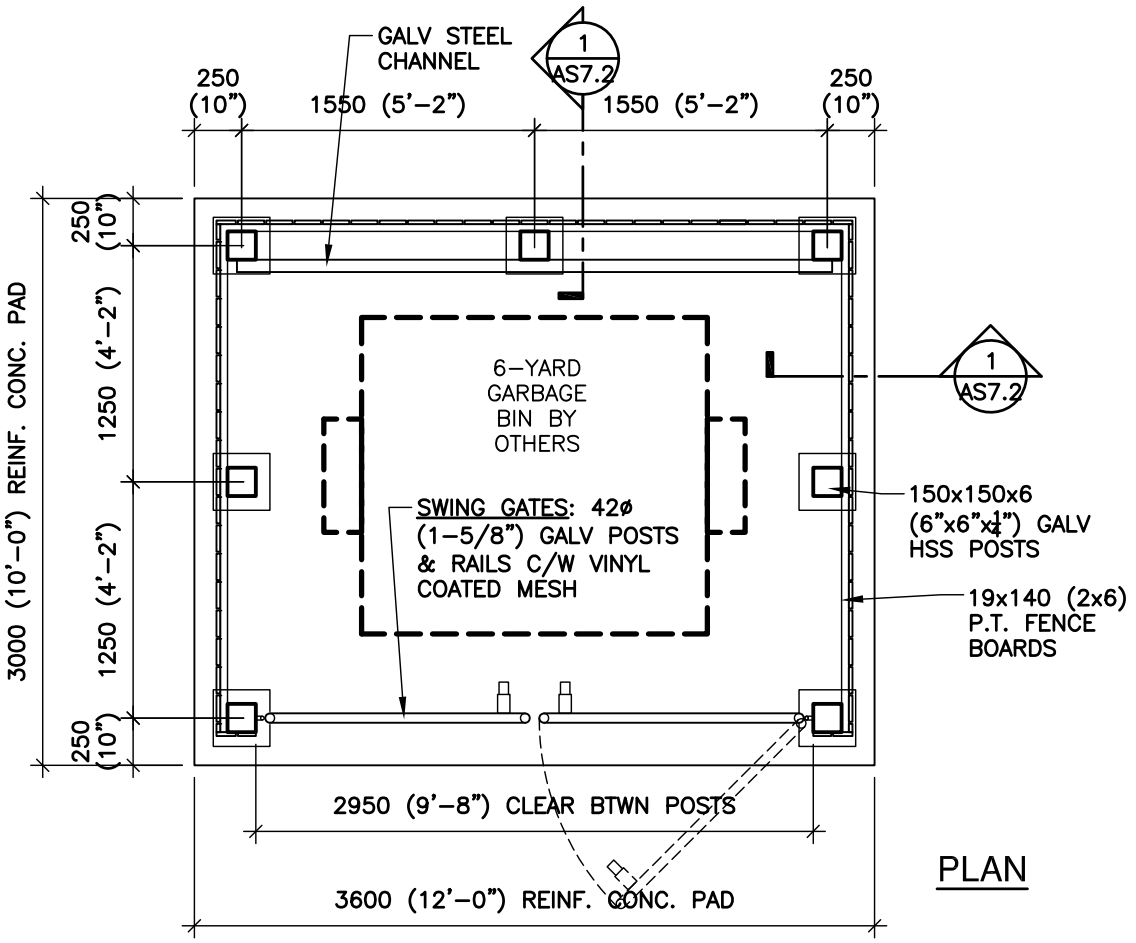
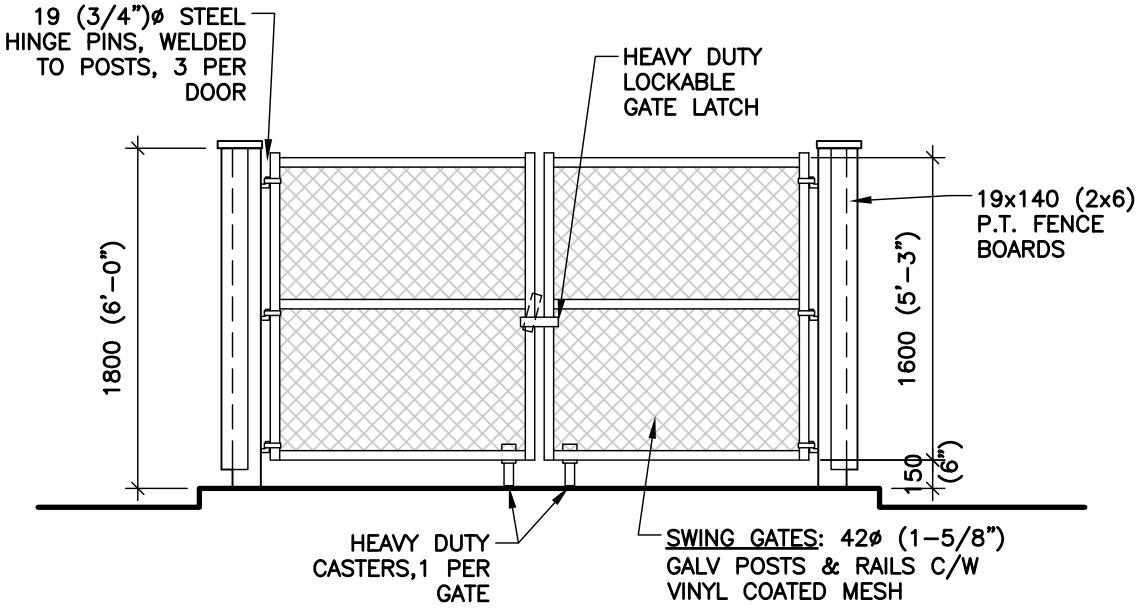


PLAN



FRONT ELEVATION

BIN ENCLOSURE

1:40

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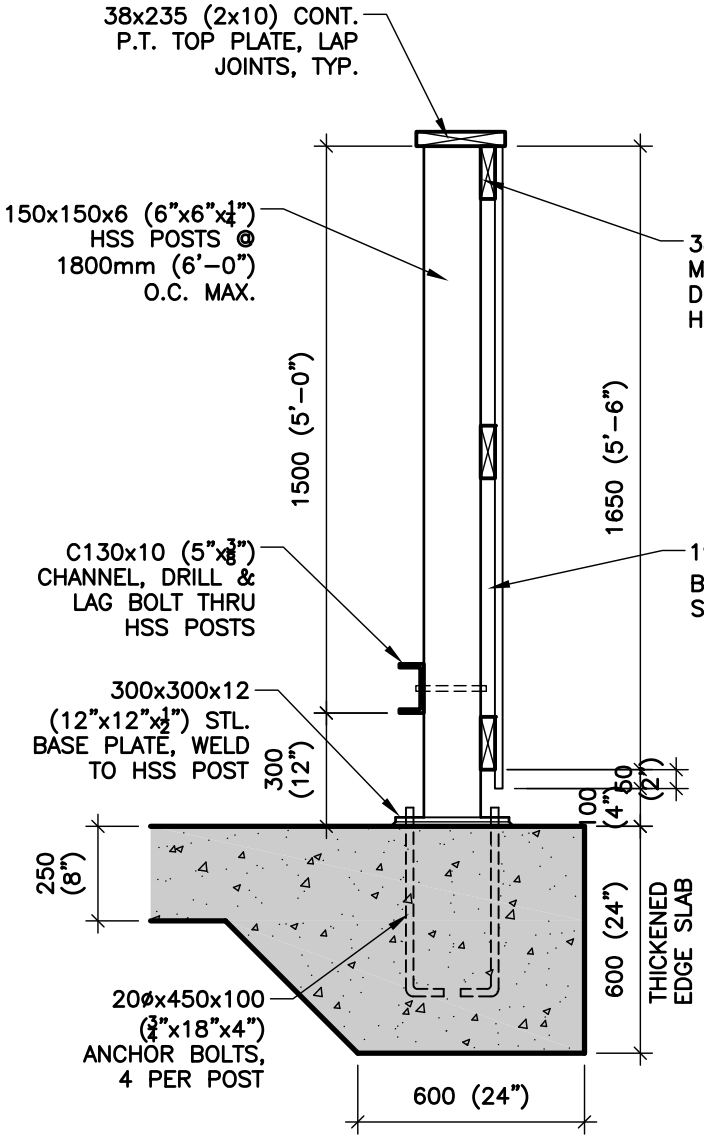

1 / AS7.2 **SECTION** 1:20

GENERAL NOTES:

ALL WOOD TO BE PRESSURE TREATED PINE, CEDARTONE COLOUR.

ALL HSS POSTS, CHANNEL, PLATES & HARDWARE SHALL BE GALVANIZED STEEL, GRIND SMOOTH ALL JOINTS.

EXPOSED ENDS OF ENCLOSURE SHALL BE CAPPED TO MATCH TOP CAP.

ALL CONNECTIONS TO BE FASTENED W/ PLATE SCREWS, MIN. 3 PER CONNECTION.

PROVIDE HEAVY DUTY RUBBER WHEEL CASTERS C/W LOCK HDWR. @ EACH SWING DOOR.

THICKENED EDGE CONCRETE PAD: 200mm (8") THICK REINFORCED CONCRETE, 15M BARS @ 450mm (18") EACH WAY W/ MIN. 75mm (3") COVER; 75mm (3") COMPACTED 'A'–BASE, 150mm (6") COMPACTED 'C'–BASE, SUBGRADE AS SPEC'D.

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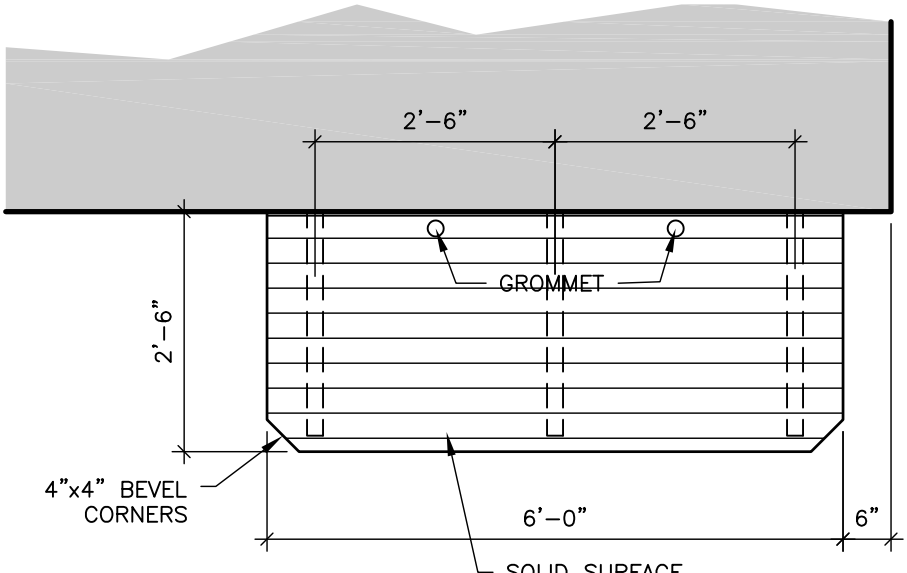
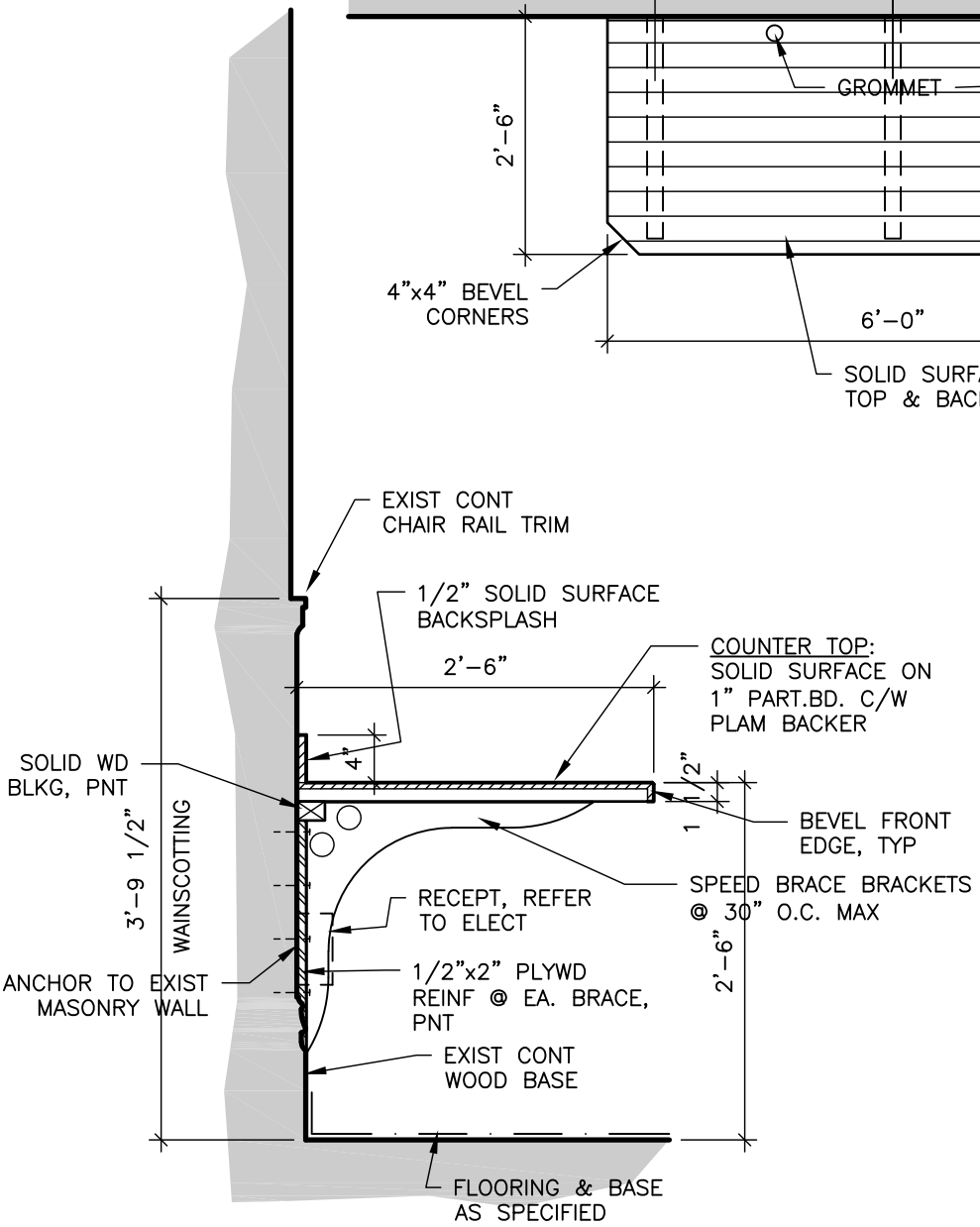
AS-7.2



PLAN

NTS



SECTION

MICROFILM WORKSTATION

3/4" = 1'-0"

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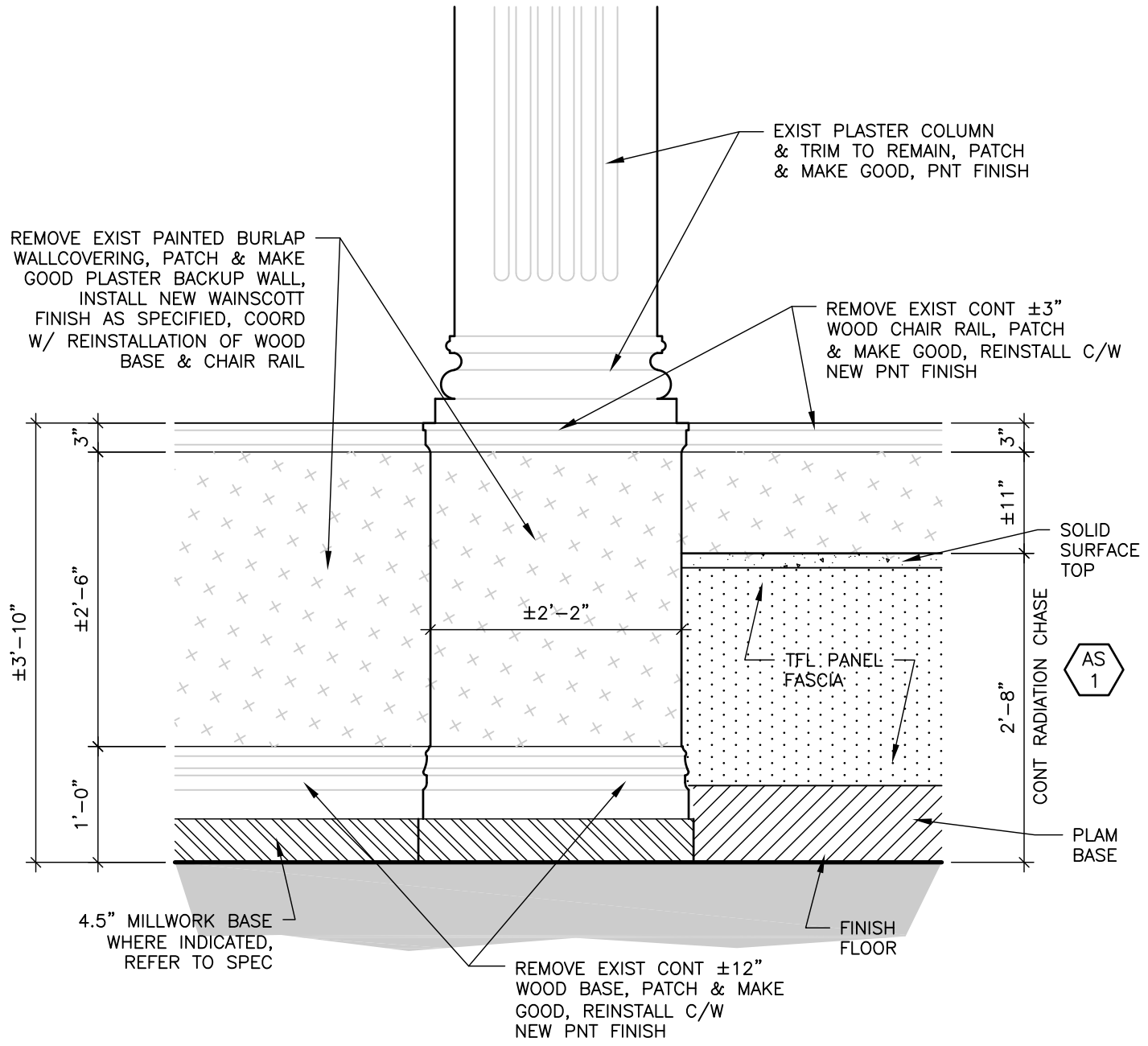
AS-8



TYPICAL WAINSCOTT

3/4" = 1'-0"

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AS-9